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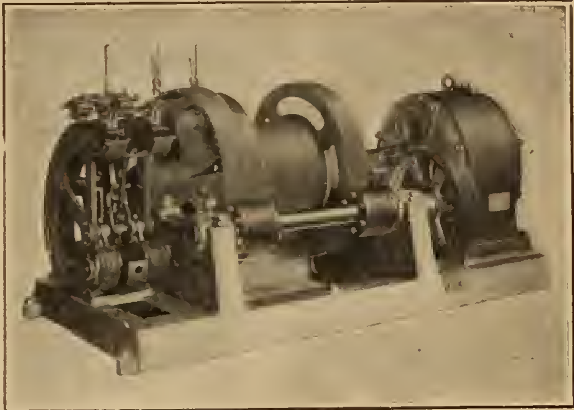

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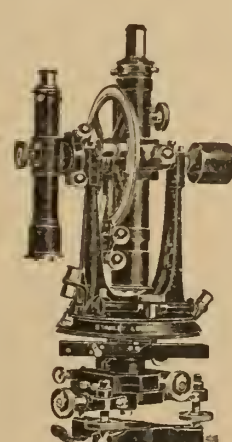

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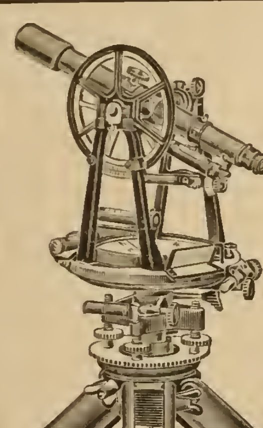

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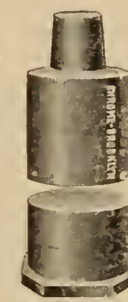

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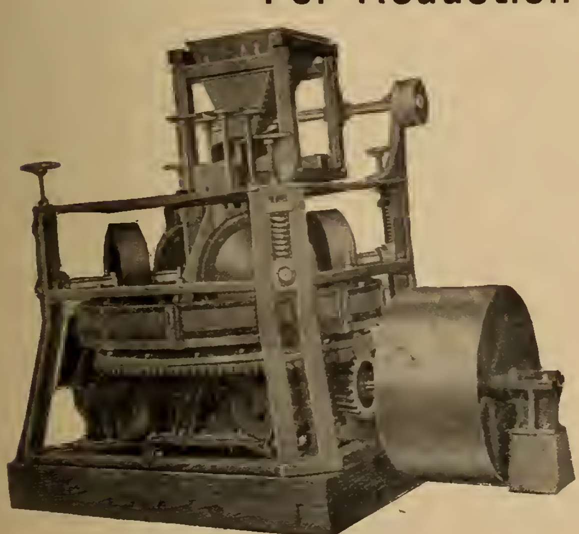

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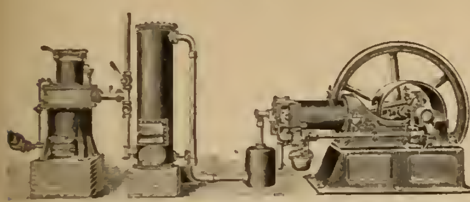

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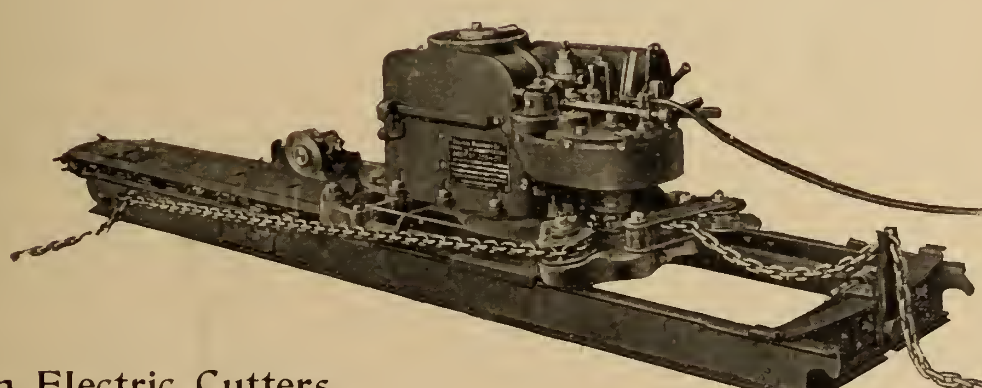

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CONTENTS.

We are informed by the secretary of the Canadian Mining Institute that the 1906 Annual Meeting will be held on March 7th, in the old historic city of Quebec. It is understood that the railway companies have, as usual, kindly offered a single fare rate to members and others attending the meeting, while special terms have also been arranged for hotel accommodation at the famous Chateau Frontenac. We also learn that an excellent programme is assured. Meanwhile a number of important papers have already been sent in, and are now in the hands of the printer. These will be distributed in advance of the meeting in order to give members unable to attend an opportunity to participate in the discussion by submitting their views in writing.

In the great mineral producing State of Colorado an area of over 50 square miles of anthracite coal has been found in the north-western county of Routt. A reconnaissance survey by officials of the United States Geological Survey extended from the Elk River on the east to Lay on the west, and from California Park on the north to a distance of 30 miles south, thus covering some 1,500 square miles. The coal beds are of cretaceous age, but have been altered to anthracite, or semi-anthracite, by the intrusion of lava beds between the layers of sandstones and shales. The vertical thickness of the coal-bearing strata varies from 1,000 to 2,000 feet. The north-eastern part of this area, between California Park and the Elk River is the one in which the cretaceous coals have been changed to anthracite, in other parts of the field the bituminous character of the coal is unchanged.

Advices from Johannesburg state that the tin industry of the Transvaal is making substantial progress, and that two corporations there are already preparing for the crushing and dressing of the tinstone. In this connection some new practice is to be introduced by local men. An attempt is to be made to separate the cassitterite from the gangue by a dry blast or air method. So far as described this pneumatic method acts by a suction current, to which the lighter portions of the slimes are attracted and drawn out through the exhaust, while the heavier particles fall by gravity and are collected into one receptacle. Whether the dry air process will be a success in its application to the tinstone of the Transvaal, is uncertain; the difference in specific gravity between the ore and the gangue is sufficiently great to anticipate a favourable result, but larger scale experiments than have been tried are necessary before passing judgment. Our intelligence is to the effect that a new crushing plant, with a capacity of 125 tons of material per day of 24 hours, is in process of erection.

We are in receipt of a little book entitled "New Year's quotations for the Geological Survey." The author's name is not stated which is a pity since some of the quotations are wonderfully apt, though in cases just a trifle vitriolic. Here are a few:—

The Survey.—"Let's in new light thro' chinks that time has made."—*E. Waller.*
B**L.—"How shall we rank thee upon glory's page?"—*Moore.*
F******R.—"Rocks whereon greatest men have oftest wreck'd."—*Milton.*
I****L.—"Better to hunt in fields for health we bought, Than fee the doctor for a nauseous draught."—*Dryden.*
L*W.—"Low was his name, but great was his desire."—*Shakespeare.*
Mc****S.—"A proper man, as one shall tell in a summer's day."—*Shakespeare.*
Mc******L.—"Though every prospect pleases."—*Hymn.*
M****N.—"The meanest floweret of the vale to thee is opening paradise."—*Gray.*
M*****S.—"Of all those arts in which the wise excel, Nature's chief masterpiece is writing well."—*Sheffield.*
W*******S.—"The languages, especially the dead, the sciences, and most of all the abstruse."—*Don Juan.*

A correspondent writing to the Victoria *Times*, expresses disagreement with some statements purported to have been made by Mr. O. T. Switzer, manager of the B. A. and B. C. Dredging Companies, in a recent interview on the subject of the disappearance of the "individual" miner from the Atlin district. The writer, after referring to Mr. Switzer's allusion to the enormous disadvantages at which the individual works by reason of the great distance to bed-rock, remarks:—"The deepest ground under operation in the district is about sixty feet, and it is being worked profitably by individuals. Furthermore, this depth is the exception, not the rule. The gradual disappearance of the individual is due to the opposition of the companies, and not because he cannot work the ground profitably." Mr. Switzer was also reported as having said that the increased gold production in 1905 was due to the operation of the large plants. In disproof of this an approximate estimate of the gold produced during the past two seasons by all companies—dredge, shovel and hydraulic—as compared with that produced by individuals, is given as follows:—1904, companies $130,000, individuals, $375,000; 1905. companies $125,000; individuals, $300,000.

One of the signs of the times in Canada is the present demand for mining machinery and supplies. This is especially the case in British Columbia. In a recent interview with the Nelson *Daily News*, Mr. Botterell, the agent in British Columbia of the Allis-Chalmers-Bullock Company, stated in this regard that his firm are now maintaining four offices in Canada, one at Montreal, one at Toronto, one at Winnipeg, and one at Vancouver, and to meet the increasing demand of the Western country have just completed a new building at Vancouver, at a cost of $250,000. Among the largest orders which this corporation have lately received have been some from the Granby Company, for the Hill Crest Coal Company in Alberta, and for the Daly Reduction Company at Hedley, in the Similkameen country; in addition to which smaller orders from other companies have been numerous. Mr. Botterell's opinion is that the outlook for the year 1906 is very bright in British Columbia, and that capital, which hitherto has been lacking now seems to be available in quantities sufficient to enable many promising properties to become productive. We are glad to note this evidence of increasing prosperity in the mining business.

The Mining Convention held in Toronto on December the 12th, no doubt served its purpose, and so far as important principles were concerned, the meeting was practically unanimous in its expression of opinion. On the other hand, a number of resolutions were passed that were quite foreign to the objects for which the convention was called, and much time and energy was thrown away in more or less useless discussion on these points. We suppose the Ontario Government not unreasonably feels that it has already done quite enough towards endeavouring to ascertain the wishes of the mining communities in respect to the revision and amendment of the present law, but we believe that much future difficulty and trouble—to say nothing of the impetus industry might be expected to derive from the framing of a good mining law—might be avoided by the appointment now of a Royal Commission to hear evidence, and to finally advise the Government as to a law which would meet as nearly as possible the requirements and conditions of the Province, and at the same time encourage and stimulate mining development. The members of such a Commission would necessarily be disinterested men, apart from other qualifications, which would enable them to serve. The services of such a man as Dr. R. W. Raymond would, for example, in such a connection be invaluable.

The remarkable richness of many of the quartz veins in the gold districts of Nova Scotia has excited the cupidity of workmen and others ever since the discovery of these mines in the early sixties; and, periodically, operators in that province are put to their wits ends to prevent the theft of gold quartz and amalgam. Quite recently the Mining Society of Nova Scotia discussed the matter, and drew up a draft of a bill to be presented to the Legislature of that province for enactment; the object of the bill being that, the finding of gold upon the person of any one, not known to be connected with the management of a gold property, should be deemed *prima facie* evidence of theft. Early in December the Waverley Gold Mining & Electric Power Co's property, at West Waverley, N.S., was robbed by the abstraction of amalgam plates from the mill of this corporation. At the time of the robbery the property was idle, and the mill locked and vacant, but about the last of November it was found that some persons, unknown, had broken into the mill, torn up the plates and removed them from the building. Investigation by the chief detective officer of the Province showed that the plates after probably having been sweated and scraped by the thieves, had been sold to a junk shop in Halifax. Many attempts have been made to trace such thefts to the perpetrators, and to have them sentenced under the laws of the Province, but with little or no success. The only case in which we can remember such robbery having been detected and the perpetrators properly punished, was on the occasion of the robbing of the mill in Oldham, N.S., in the year 1894, when the two thieves who were brothers, were convicted and sent to Dorchester penitentiary for a period of 3 years.

We can scarcely congratulate the Le Roi shareholders on the action taken at the recent meeting,—either in re-electing Mr. A. J. McMillan to the Board or in rejecting the amalgamation proposal. But the folly of the average English shareholder is proverbial. That, however, is a matter with which we should have no concern, but for the fact that Canadian industry is injured by this fool's folly; and all things considered we nearly feel like saying that it would be better for this country if Englishmen would keep their money at home rather than Canada should get the blame for the countless costly mistakes, bad investments, rotten management, and general idiocy that has characterised so many English-mining ventures in Ontario and British Columbia in recent years. The Englishman is terribly afraid of being "taken in," and probably the chief reason—apart from the exploitation hinted at by the London press that the meeting was "packed"—of the rejection of the resolution favouring amalgamation, was Mr. McMillan's clever recognition of this weakness and his successful appeal to the prejudices of his audience in insinuations regarding the machinations of Canadian interests. How unfair such a meeting can be was shown by the fact that one so disinterested as Prof. Brock was not allowed to speak, but when he attempted to do so his remarks were drowned by cries of "sit down, you're a Yankee!" It is, however, little use in bewailing spilt milk. The scheme, which had it been carried through would undoubtedly have greatly increased the profit-earning possibilities of the respective mines, has so far as the Le Roi is concerned, fallen through. Mr. McMillan is now on top and must enjoy the sensation of having kicked away the prop by which he climbed there. It is not a particularly bright outlook for Le Roi.

————

One of the important exhibits in the mining section of the Lewis & Clark Exposition at Portland, Oregon, was a model of a new quicksilver furnace, embodying an entirely new idea in the distillation of quicksilver from cinnabar. The furnace is the invention of Mr. W. E. Denis, Manager of the Black Butte quicksilver mine, Oregon. The furnace is primarily designed to treat low grade ore by volatilization, its inventor claims its adaptability to the roasting of other ores when needed. The results claimed for the new apparatus are:—first, large capacity for small initial cost; second, perfect combustion of the fuel, or organic matter of the ore; third, entire elimination of soot in the condensers; fourth, complete extraction in one process, requiring no treatment of residues; fifth, a nearly complete 100% recovery, due to the absence of smoke and steam.

The Denis furnace is fired by gas, the gas being generated in a separate producer. The condition of the fire is under the direct control of the operator, and depends upon the amount of air inlets, the arrangement and manipulation of which is a part of the patent. The gas from the producer is carbon monoxide (C.O.), which is drawn down and under the grate arch of the fire box to a gas holder, from which it is distributed to a series of superimposed combustion chambers, arranged on opposite sides of the ore tower. At each of the combustion chambers hot air, under control, is admitted, and here the carbon monoxide is converted into carbon dioxide, or carbonic acid gas, just before the gas passes over the cinnabar, thereby effecting complete combustion at the point where the heat is to be utilized, and occasioning the least loss possible from travel and radiation. The ore tower through which the pulverized ore is dropped consists of a series of superimposed zones, so contrived that the temperature of each is under easy regulation and control. The stirring of the ore is accomplished by gravity, without the use of rabbles, and it is claimed for the apparatus that no precipitation of metallic mercury within the furnace is possible, and further, that it is impossible for any unroasted fines to pass over to the condensers.

Mr. Denis claims complete extraction of quicksilver in four hours roasting, whereas the ordinary type of quicksilver furnace requires from 24 to 48 hours. This saving of time, as claimed, gives the new furnace six times the capacity of the old type furnace, half areas being equal.

————

The Delaware, Lackawana & Western Railway Company have lately been carrying on a most interesting series of experiments in the application of electricity to the rapid hoisting of water from the Sloan mine, near Scranton, Pa. This shaft has a depth of 535 feet vertically, and drains all the collieries of the company in that particular division; the duty performed by the hoist requires the load to be raised to a height of 550 feet, and the capacity is to be 5,000 gallons a minute, or something over 16½ tons of water, 550 feet per minute, Including the weight of the rope the total load hoisted is over 18 tons, requiring 610 net H.P. To handle this large amount of water necessitated the use of large tanks which, on their part, had hitherto required to be operated or controlled by hand. The new idea in the experiment is the effort to have this hoist work automatically, and the design is to be put to the credit of Mr. H. M. Warren, the company's electrical engineer. Should the machine realize the hope of its builders, the man in attendance will have nothing to do save to sit by and watch, so as to put on brakes in case of any accident or derangement of apparatus. Owing to electrical difficulties it was decided that the hoist to operate these large tanks must be provided with a motor running continuously in one direction, and not reversible. The task of carrying out the mechanical details and providing the automatic attachments was confided to the Wellman-Seaver-Morgan Company, of Cleveland, and the electrical controlling devices were furnished by the Electric Controller & Supply Company, also of Cleveland, Ohio. The Wellman-Seaver-Morgan Company had already had large experience in using motors and hoists operated similarly to this large motor, and the method which they had successfully employed on these other hoists was adopted for this larger one. The mechanism by which this was effected consisted of a motor driving a pair of bevelled gears through one single bevelled pinion. The bevelled gears run loose on a shaft, and are each provided with a Webster, Camp & Lane friction clutch, the operating mechanism for which is so designed that while both clutches can be out at one and the same time, yet only one clutch can be thrown in at a time. The mechanical device by which the hoist is controlled is somewhat complicated, depending upon solenoids acting directly on both clutch valves and brake valves. If this feat of automatism in the operation of the mechanism by which the direction is changed as the tank is emptied of its load, is successful, it will be the first of its kind known to the engineering world, and will necessarily be a matter of considerable interest. That the coal Company, however, believes in taking all necessary precautions against failure is shown by the fact that it has installed a huge pump at the bottom of the shaft with aacapacity equal to the water seepage of the property.

While on this matter of the problem of water in mines, it may not be out of place to mention the fact that the Pennsylvania Coal Company, in order to get rid of the water at its Dunmore collieries, is now engaged in driving a tunnel from the mines to the Lackawana River, which when completed will drain the collieries by gravitation. The task of getting water out of deep mines is far more expensive than is usually realized by those who have not had actual experience in the matter. In some collieries it is necessary to pump from 7 or 8 to 14 tons of water for each ton of coal raised to the surface, and the expense, not only of the operation, but of the installation of the appliances necessary for this purpose, means such an outlay, not only for first cost, but for maintenance and operation, that prices of coal are not always so profitable to the company as might be imagined from the simple figures asked.

Dr. Robt. Bell, Acting Director of the Geological Survey, in a letter which we publish in our correspondence columns, takes exception to the views expressed in an editorial paragraph appearing in last months issue of the Mining Review, commenting on the desirability of greater co-operation between the Survey, the Mines Branch of the Department of the Interior. We regret exceedingly if we have unwittingly given Dr. Bell just ground for complaint, and it is needless to add that our comment was in no sense intended as a reflection on the general work of the Survey, members of whose staff, notably Messrs. Fletcher and Faribault in Nova Scotia, Dr. Barlow in Ontario, Messrs. McEvoy and Brock in British Columbia, and Mr. McConnell in the Yukon, (to go no further back) have done yeomen's service for the mining industry. At the same time we can hardly admit that the argument advanced by our correspondent is such as to incline us to amend in the main our already expressed opinions. Dr. Bell states that the comments regarding the publication of his department, and concerning the relations existing between the Survey and the Mines Branch, are misleading and untrue. It is certainly a fact that the Survey was the first to print reports on the two subjects dealt with in the recently issued Mines Branch monographs. That this point was not made sufficiently clear in the paragraph referred to, may, and doubtless does, appear unfair. We, therefore, hasten to make amends. But that the relations between the two departments is far from cordial, is a fact so generally known that it is scarcely a subject for argument. Dr. Bell further remarks that the Mines Branch monograph on Asbestos and Mica do not give, and do not profess to give, any original information on these subjects. We quite agree; and it were absurd to expect otherwise. The reports are not original, but descriptive. The information is of the character the investing public requires and demands, and which other countries, notably Great Britain and the United States, are ready enough to accord. Dr. Bell, for example, instances the point that the Survey has refrained from publishing details of mining machinery and of the cost of mining, on the score that mining men may object "to their ideas being given away to competitors, while, in respect to costs, there is always a fear of supplying unscrupulous promoters with powder and shot." So far as we are aware there is only one branch of the mining industry in Canada in which there is any sort of attempt at secrecy regarding the machinery used, and the special methods followed by the several operators in turning out a marketable product. That is the asbestos industry. It is confined to a limited area, and is controlled by a relatively few large undertakings. In such a case as this it would, of course, be quite proper for the author of a Government report on the industry to submit a proof of his description of individual properties to owners and request a revision before sending the report to press. In fact, such a course might well be generally followed. But on the subject of costs we fail to see the force of Dr. Bell's reasoning. If a Government report is merely a conglomeration of generalities, what useful purpose can it possibly serve. Before investing in any undertaking the capitalist wants to have facts—definite and tangible facts—before him. He requires to be in a position to calculate his chances of profit or loss. And it is a decided advantage to him to have these facts presented in concise and handy form, thus rendering largely unnecessary the consultation of many works and books of reference bearing on the subject in question. For this reason, too, brief but comprehensive summaries of industrial conditions in foreign countries are eminently valuable.

Apropos of the foregoing we are, of course, aware that a Mines Section of the Geological Survey was established so long ago as eighteen years, and was intended to be the parallel of the Division of Mineral Resources of the U.S. Geological Survey. This branch of the Geological service is certainly entitled to all credit for the pioneer work accomplished, so far under very difficult circumstances; for it is evident that without a reasonably definite appropriation or grant of money, and with an altogether inadequate staff it has been a practical impossibility for the officer in charge of this Mines Section to afford the public that sort of precise information covering so wide a field as is demanded.

A PROPOSED U. S. DEPARTMENT OF MINES.

The movement in the United States to secure a federal department which shall have charge of the mining industry of the country under the direction and administration of a responsible member of the cabinet is again gaining force, and Mr. Van Duzer, Congressman, of Nevada, has already introduced in Congress a bill providing for such a department. The bill enacts that there shall be, at the seat of Government, an executive department known as the Department of Mines and Mining, with a head appointed by the President, who shall have a seat in the cabinet and shall receive the salary of $8,000.00 per annum. It is proposed that this Department of Mines and Mining shall have general jurisdiction over all matters pertaining to mines and the mining industries, the Geological Survey, and in fact over all matters committed to any of the Bureaus, departments or branches of the public service transferred by this act from other executive departments of the Government to the Department of Mines and Mining. Also, that there shall be in the said Department of Mines and Mining a Bureau which shall, under the direction of the Secretary thereof, gather, compile and publish information in regard to the same, and disseminate practical and useful information concerning the mines, mineral resources and mining industries of the United States; that the office of the Director of the Geological Survey and the Geological Survey service, and all that relates to and pertains to the same, shall be transferred from the Department of the Interior to the jurisdiction and supervision of the Department of Mines and Mining, and the Director of the Geological Survey is hereby made the director of the said bureau. Subsequent sections refer to the business management of this department, obliging the Secretary of the department to make an annual report of receipts and expenditures, of special investigations and reports required by the President, the Senate or the House of Representatives, and placing in the Secretary's hands the charge of all buildings and premises, with their libraries and contents, and providing for the issuance of regulations for all subordinate officials. The final section of the bill provides that the jurisdiction, supervision, management and control of mines, mining lands and mining industries, now vested in the Department of the Interior, shall be transferred to and invested in the Department of Mines and Mining.

The movement is interesting, inasmuch as it so aptly coincides with the suggestions made, three years ago, at a meeting of the Canadian Mining Institute for the reorganization and better equipment of the Geological Survey of Canada.

MINING FRAUDS AND STATE INTERFERENCE.

Among the notable papers read at the meeting of the American Mining Congress in El Paso, Texas, during November, was one by the State Mineralogist of California, Mr. Lewis E. Aubury, on "The prevention of mining fraud by state legislation." Mr. Aubury considers that the greatly increased attention now paid to mining necessitates the enactment of stringent laws to protect the investor in mining properties, and thus there is a necessity for legislation to that end in the mining states of the Union. The familiar prospectus of the "fake" mining company, which is successfully used to extract money from the pockets of ignorant investors, whose cupidity is appealed to by the possibility of huge returns from small investments, is well described. We wish, however, that we could endorse Mr. Aubury's contention that millions of dollars of capital are at present passing by the United States and seeking investment in Mexico, South America and *British* possessions. As a matter of fact, Canada during the last ten years, in proportion to its population, has suffered fully as much from promotion frauds as has the United States. Some of Mr. Aubury's remarks are, in fact, directly applicable to the Canadian situation, the following extract being singularly appropriate:—"The investor, with no knowledge of mining, is not generally able to distinguish the good from the bad, and it is useless to tell him of the necessity for securing expert opinion *before* investing. He listens to the tale of the 'faker' and obtains expert advice *after* he has invested, and when the promise made to him has failed to materialize. When he realizes the fraud he forever abjures mining and mining operators, and loses no opportunity to condemn the same." If these words do not correctly describe the general attitude of Eastern Canadian capitalists, we know of none that will. Mr. Aubury then quotes the bill which he introduced at the last session of the California State Legislature, and which duly became law. The statute reads as follows:—

"SECTION 1.—Any superintendent, director, secretary, manager, agent, or other officer, of any corporation formed or existing under the laws of this State, or transacting business in the same, and any person pretending or holding himself out as such superintendent, director, secretary, manager, agent, or other officer, who shall wilfully subscribe, sign, endorse, verify, or otherwise assent to the publication, either generally or privately, to the stockholders or other persons dealing with such corporation or its stock, any untrue or wilfully and fraudulently exaggerated report, prospectus, account, statement, of operations, values, business, profits, expenditures or prospects, or other paper or document intended to produce or give, or having a tendency to produce or give, to the shares of stock in such corporation a greater value or less apparent or market value than they really possess, or with the intention of defrauding any particular person or persons, or the public, or persons generally, shall be deemed guilty of a felony, and on conviction thereof, shall be punished by imprisonment in a State prison, or a county jail not exceeding two years, or by fine not exceeding five thousand dollars, or by both.

"SECTION 2.—All acts and parts of acts in conflict with this act are hereby repealed."

Concerning the operation of this law, Mr. Aubury admits that the time is too short to report as to its full benefits. At the time of its enactment California was flooded with mining literature containing the usual glaring misrepresentations which were printed, as usual, in the daily press of the State. Mr. Aubury says that since the passage of his bill the prospectus has disappeared from the state, and the faker has sought fresh fields for exploitation. The State of Washington has enacted a similar law to that framed by California.

Mr. Aubury is wise enough to recognize that you cannot make men honest by Act of Parliament, and that his suggestions, as to restrainment by state legislation, may be opposed. He takes the higher standard that, while a large number of people with money may need the services of guardians, yet the mining industry of a country demands, as its due, that the citizens of that country should use every means in their power to safeguard and elevate legitimate mining.

While it is improbable that legislation of this character will be adopted by the Canadian Provinces in which mining is carried on, it is to be hoped that some steps will ere long be taken in this country to limit the activities of the mine "boomster" by penalising the publication of laying prospectuses and advertisments

IRON ORE SUPPLIES.

In a recent issue, the *Iron and Coal Trades Review* devotes considerable space to a critical editorial comment on the iron ore resources of the world. In this article the conclusion is reached that, the conditions which at present govern the iron ore supply of the world must suffer revolutionary changes within the next half-century, and the prediction is made that the conditions now obtaining will be profoundly modified within only *ten* years. At this time when the consumption of iron ore in the world is greater than it has ever been, such an article from an authoritative source is of exceptional interest, although attention has been repeatedly called of late to the fact that known supplies of iron ore are being rapidly exhausted. Meanwhile the American Iron and Steel Association, in a recent publication by the secretary, Mr. James M. Swauk, gives some figures abundantly justifying the general tenor of the article to which we have reference. For example the present blast furnace capacity of the United States alone has now reached the enormous figures of 31,465,000 tons, which is greater by nearly four million tons than the furnace capacity for 1903, as given by the same authority in "The Mineral Resources of the United States." This huge tonnage is more than the world's total production of pig iron ores for any one year prior to 1895. Again, whereas the actual production of pig iron in the United States in

The Hon. J. Prevost, the new Minister of Colonization, Mines and Fisheries in the Quebec Government. Mr. Prevost has expressed himself as being very desirous of promoting the development and welfare of the mining industry in the Province of Quebec.

the year 1903 amounted to 18 million tons, the monthly production of pig iron at the end of the year 1905 was at the rate of 26 million tons of "pig" per annum.

This remarkable increase, (of which we have definite figures for the United States,) was not confined to that country, but extended also to Germany, Great Britain, and the other smaller producers of the world; e. g. the capacity of the German furnaces has now reached between 12 and 13 million tons per annum, the capacity of Great Britain is put at about 11 million tons, and, while the Furnace capacity of France, Belgium and Austria is not accessible, yet the figures of *exports* from these three countries show that they have increased by percentages running from 12 to 15% over the figures for 1904. Russia, owing to the war with Japan, has suffered in her iron industry as in almost every other respect. As our contemporary remarks the situation, as regards raw material for supply, "is one to give us pause."

The *Iron and Coal Trades Review* in a previous issue published a Swedish compilation of the unexhausted iron ore resources of the world, in which the estimated available ore remaining in the whole world was put at ten thousand million tons. Let us see how long this would last the world at the present figures of increased consumption. As the 1903 figures for the whole world were 101 million tons of ore consumed for a metallic production of 46,420,000 tons, the present yearly consumption of ore, in the same ratio, would be approximately 30 millions of tons more, or, say at the yearly rate of at least 130 million tons of ore. Provided no increase in consumption was required the supply given by the Swedish expert would suffice for 75 years. Consumption however is not standing still but is increasing rapidly and steadily every year, and there is reason to believe that it will greatly increase in the future, and therefore that, as the *London Journal* suggests "We would seem to be within little more than half a century of an absolute iron famine."

So far as the American continent is concerned, we know that in the United States the enormous resources of the Lake Superior region, embracing five ranges and supplying 70% of the total production of the United States, are almost entirely required by home furnaces and that there is no surplus for export. In Spain, the Bilbao ores have more markets than can easily be supplied; Sweden has little or no surplus for export, and such new deposits as are opening in other parts of the world cannot be considered as prospective producers of ore for export for some time yet. It is at this point that the resources of the Dominion of Canada in respect to iron ore loom up quite largely, and are entitled to most serious consideration. The present Wabana deposit of Newfoundland is singular in that it is the one which is most vigorously worked, with the possible exception of the Helen mine, in the Michipicoten range, but at other points in Newfoundland, and at many points throughout Labrador, large but unexploited deposits of iron ore have been noted and examined by Mr. A. P. Low, of the Canadian Geological Survey, and, from his reports, seem only to require exploitation to become very large sources of supply. In the new district in the northern part of Quebec, lying west of lakes Chibogamoo and Wahkonichi, magnetic iron ore is a possibility having already been found in small bodies with indications of much larger ones. Westerly in Ontario, the Hutton, Atikokan and Animikie districts, or ranges, are not only being exploited but are actually producing small quantities of merchantable ore. For these Ontario ranges transportation only requires to be supplied to enable them to be important factors in the supply of iron ores. Westerly, in British Columbia, the high grade deposits at Kitchener and the reported discovery of hematite in Cariboo district must be noted, in addition to which there are the tidewater deposits of the western side of Vancouver Island, near Port Renfrew, the ores of Texada Island and the entirely unexploited resources of the coast to the north. It is not, we think, optimistic for Canadians to believe that within their own Dominion they have supplies of iron ore sufficient to last their own requirements for the next 100 years, and this without going into the matter of the smaller and less pure deposits which are known to exist in Cape Breton, portions of Quebec, and the older and eastern portions of Ontario. At the present time with the large production of high grade ores, many of which are Bessemer, in the republic to the south of us, there has been no commercial need for the exploitation of our iron resources, but with the continued rapid growth of Canada which we have witnessed during the last ten years, it is only a question of a short time before we shall have positive knowledge, not only of the quality, but also as to the quantity, of these iron ore deposits.

Somewhat remarkable improvements in the quality and quantity of the reserves at the Helen mine have not been made public, but we are in a position to assure our readers of the fact that they exist, and that the Helen mine alone, apart from any other opening on the Michipicoten range, will supply a very large volume of ore in the future. On this range (Michipicoten) other deposits are known, some of which (the Josephine) have been partially developed and others have no development whatever.

The reports which have been brought in, during the last two seasons, by the Grand Trunk Pacific surveyors, have contained numerous references to magnetic attractions which have rendered the compass useless for short distances, and some have contained references to large bodies of iron ore, supposedly of the character of magnetite. The Swedish compiler, whose figures our contemporary has used, in all probability knew nothing of the iron ore discoveries of the northern half of North America, and while his figures may cause temporary consternation amongst the iron masters, they cannot be considered inimical to the iron industries of the Dominion, whose vast stores of raw material are only just beginning to be realized by Canadians themselves.

The last mail brings to our table authentic information concerning the iron ores of Australasia which recently have been investigated, in consequence of the determination of the government of New South Wales to aid the establishment of a steel industry in that colony. While Victoria has few, if any beds of iron ore, West Australia, South Australia and Tasmania have large deposits, sufficient for home consumption for more than half a century.

1905-6.

The year 1906 opens under peculiarly favourable auspices for the mining industry in Canada. For some time past evidence has not been lacking of a slow but steady rehabilitation—a recovery from the depressing reaction of inflation and exuberant boom by which a too enthusiastic and optimistic public signifies its awakening realization of important potentialities. A boom is often merely a premature estimate of potential value. It is misdirected energy, and is responsible therefore for much seeming waste. As such it is deplorable. There is a sowing of the wind and a reaping of the whirlwind. The field is strewn with the corpses of the slain, and the cries of the wounded call aloud for pity and retribution. But just as a decisive battle may clear the atmosphere of international complications, though it unbalance temporarily the equilibrium of trade, so the boom, which it seems every mining region of importance in America must sometimes experience and suffer, is not necessarily an unmixed evil. Given substance, as well as shadow, sooner or later some will be found wise enough to grasp the substance. While ten dollars may be thrown away on wild-cats, the boom will have been responsible for the investment of one or two dollars judiciously. It has at any rate attracted some capital to the country. In time this must tell. The wild-cats are relegated to the limbo of wild-cats. They are forgotten in the light of better things, and industry which before was secondary to speculation, now takes her proper place. That is what has taken place, and is still taking place, in Canada, and who shall say but that for the Rossland boom of 1896, mining in the Kootenays to-day would be on so substantial a footing. No doubt the process was drastic, the methods quite indefensible, but we have nevertheless to consider facts and accept them for what they are.

It is yet rather too early for us to be able to present an exact statistical statement of the past year's mining operations, but it may be very confidently said that with the exception of Yukon results, which show a falling off, there has been a general increase in mineral production in Canada during 1905. The decrease in the Yukon has, however, no special significance as indicating the exhaustion of the gold areas, but is almost entirely ascribable to a scarcity of water, the past season having been an exceptionally dry one. The chief features of the year in the Yukon have been the inauguration of dredging on a more important scale, and the new quartz discoveries and developments at Windy Arm, Tagish Lake.

The mineral production of British Columbia for 1905 will, it is estimated, have a value of not less than twenty-one million dollars, or an increase of three million dollars over the returns of the preceding year. This estimate appears to us to be well within the mark, or even below it. The great gain in B.C. has been in copper, silver, lead and zinc production, all of which industries have been stimulated by the improved market conditions. The year has been specially marked by important zinc mining developments, and the establishment of reduction works in the Province to treat zinc-bearing ores. More mines probably were worked on a satisfactory margin of profit last year than ever previously, and considerably greater aggregate amounts were distributed in the form of dividends.

In consequence of British Columbia's large mineral output this year, it claims more than ever to have earned the proud title of "the Mineral Province of the Dominion." We are not so sure, however, that if Ontario cared to challenge for the title she would not make so bad bid for it. It is a well known fact that it is easy to juggle with figures to make them tell almost any sort of a tale according to the manner in which they are compiled. Now the Ontario Bureau of Mines has proceeded on the assumption that the proper basis for valuation is the wealth of the products in the highest condition of refinement to which they are brought at the mines or works in this Province. Other authorities, however, such as the Geological Survey at Ottawa, and the Mines Department of British Columbia, compute the values of the output at the price of the refined metal. This, as will be admitted, makes comparison, between the output say of British Columbia and the output of Ontario very unfair to the latter. For instance, Ontario values copper at about eight cents per pound in the matte or concentrates, and nickel at about seventeen cents per pound in the matte. British Columbia, on the other hand, values its copper at the full market value for the refined metal, which at the present time is about seventeen cents a pound. Lead is also valued in British Columbia at the full market price for refined lead, while the Geological Survey estimates nickel in the matte in Canada as being worth whatever the average value of the metal is in the markets of New York during the year. The nickel contents of ore and matte for 1904 were made up by the Survey at 40 cents per pound. On this basis of valuation, the production for 1905, not including steel, but including both metallic and non-metallic products, will probably reach $16,500,000.00 or $17,000,000.00, while if the British Columbia or the Geological Survey bases were adopted the values would be, perhaps $21,000,000.00 or $22,000,000.00. The figures for 1904, as published by the Bureau, show a total value of $11,572,647.00. The output of steel in Ontario for 1905 will have a value of over $3,000,000.00. The increase is largely due to the new source of silver opened up in the Cobalt mines, and to heavy advances in the production of nickel, copper and pig-iron.

In Quebec, the great feature of 1905 was the new discoveries in the Chibogamoo district, which is likely to become, once transportation facilities are provided, one of the most important productive areas in Eastern Canada. An increase in mineral output will also probably be shown to have been made by this province also, and we expect in next month's issue of the Review to publish an authoritative statement in this regard. In the Eastern Townships the asbestos industry has enjoyed a most prosperous year.

We publish elsewhere an estimate of mineral productions in Nova Scotia for 1905. It will be noted that the coal shipments were the largest on record, and are estimated to have reached the considerable value of approximately $11,250,000.00. Of almost greater importance, however, are the important developments that have taken place in the iron and steel trade, last year having seen inaugurated the rolling of steel rails in the province. The works of the two big companies have, in fact, been most busily employed filling orders in all departments, and have now sufficient work on hand to keep the plants in operation at their full capacities for some months ahead. Only a slight increase in the gold output is anticipated.

In wishing our readers a prosperous and Happy New Year, we feel that there is every probability of this being realized in the mining industry. Conditions are now more stable than they have been for years past; there is little to fear in the way of labour troubles or disturbances; industry is becoming established on a firm and substantial basis; and new and promising territory is being opened up throughout the Dominion.

THE DEEP SHAFTS OF THE WORLD.

The following table, showing the location, size and depth in feet of the principal deep shafts of the world, will be of interest to many of our readers. The deepest shafts, as will readily be seen, are those in the copper region of Michigan, on the Keweenaw Peninsula, with the Driefontein Deep shaft in the Rand, S.A. a close second:—

There is no gainsaying the important part electricity is now playing in respect to the economies of mining. One of the latest Canadian applications is that of the Dominion Coal Company, at its Dominion No. 2 shaft, where it has been decided to install a central station of large size to develop electric power in quantity sufficient to operate all of the collieries of this Company. As a first instalment, three generators of 650 H.P. each, will be put into service, their power being distributed by wire to the various collieries, doing away with the maintenance of the individual steam plants at the respective collieries. The various pumping stations of the company will first be done away with, and the pumps will be operated by electricity. The longest distance over which power will be transmitted for the present will be about 8 miles, to Dominion No. 6. The instalment has been decided upon, after extensive examination and investigation by Mr. H. F. Parshall, an eminent London electrical engineer, who reports that such favourable conditions for the installation of electrical methods do not obtain elsewhere to his knowledge. The Dominion Coal Company will be the first company in America to install a large scale electric plant for the operation of its collieries; while the principal collieries of Germany and Belgium now utilize it for central power stations, there are none in the Pennsylvania region, which have utilized it to such a large extent. The Dominion Coal Company will not be alone in this matter of applying electricity for the operation of its mines. The Nova Scotia Steel & Coal Company, which is preparing to open up a new colliery a mile north of the present No. 3 shaft, is also about to install a plant to do all pumping, winding and ventilating by electricity. In this manner the collieries of Cape Breton will be the first in America to utilize the electric current for operations on a large scale.

Name	Location	Material Mined	No. of Compartments	Size of Hauling Compartment	Size of Shaft over all	Depth in Feet	Remarks
Red Jacket	Calumet, Michigan	Copper	6	6 ft. 3 in. x 7 ft.	25 ft. x 15 ft. 6 in.	4900	Probably deeper at present day.
Tamarack	Tamarack	Copper	5	7 ft. 2 in. x 5 ft. 2 in.	29 ft. 2 in. x 8 ft. 10 in.	4615	
Driefontein Deep	Rand	Gold	7	5 ft. x 6 ft.	42 ft. x 8 ft.	2000 4000	Six compartments 6 ft. x 5 ft. and one 6 ft. x 6 ft. 6 in.
Ashton Moss	Manchester	Coal		Circular	16 ft. diameter	2880	Hoists total distance in 1 min. 25 secs.
Con. California and Virginia	Virginia, Nevada	Silver, gold	3	5 ft. 4 in. x 4 ft. 6 in.	19 ft. x 7 ft. 8 in.	2500	Pumpway 5 ft. 4 in. x 6 ft.
Cadeby Main	Yorkshire	Coal		Circular	16 ft. diameter	2253	
Rose Bridge	Wigan	Coal	..	Circular	.....	2446	Max. speed of hauling 5,100 ft. per min., or 57 miles per hour.
Dinas Main	South Wales	Coal	..	Circular	18½ ft. diameter	1794	Sunk and walled in 16 months
Silkstone Colliery	Sunderland	Coal	..	Circular	16 ft. 6 in. diameter	1740	Hauls 2,000 tons in 8 hours.
Newbattle	Edinburgh	Coal	..	Circular	20 ft. diameter	1658	Hauls 2,000 tons in 7½ hours.
Centennial Eureka	Eureka, Utah	Gold, silver	3	4 ft. 2 in. x 4 ft. 2 in.	5 ft. 6 in. x 12 ft. 8 in.	1610	Manway 2 ft. 4 in. x 4 ft. 2 in.
Ontario	Park City, Utah	Silver	3	4 ft. 6 in. x 5 ft	7 ft. x 20 ft.	1500	
Hazleton	Hazleton, Pa., U.S.A.	Anthracite	5	7 ft. 6 in. x 12 ft. 6 in.	37 ft. x 13 ft. 10 in.	1150	Pumpway 3 ft. x 12 ft. 6 in.
No. 5 shaft	Wilke's Barre, Pennsylvania, U.S.A.	Anthracite	5	7 ft. 6 in. x 12 ft.	12 ft. x 52 ft	1039	2 hoistways, pumpway, upcast 12 ft. x 14 ft. 10 in., downcast 12 ft. x 12 ft.
Anaconda	Butte, Montana	Copper	3	4 ft. 6 in. x 5 ft.	20 ft. 4 in. x 6 ft. 8 in	....	
Butte and Boston	Butte, Montana	Copper	3	4 ft. x 4 ft. 6 in.	18 ft. 4 in. x 6 ft. 2 in.	....	

A LEAD AND ZINC CONCENTRATOR AT ROSEBERRY, B.C.

By Alfred W. Dyer.

The late successful run of the lead and zinc concentrator at Roseberry, Slocan lake, erected by the Monitor and Ajax Fraction Company and treating the ore of the Monitor and Bosun groups, has attracted some attention, especially in view of the importance of the problem, successfully solved, of the present zinc commission of enquiry undertaken by the Dominion Government and of the general advance in the price of both spelter and lead. That which has been done by this company can be imitated by others as it is by no means claimed that the Monitor and Ajax has the only properties in the Slocan which are worth the working.

The company's mining properties are the Monitor and Ajax groups. The Monitor group, consisting of eight claims, is situated at Three Forks on a branch line of the Canadian Pacific, the Nakusp and Slocan railway. The Bosun has also a total number of eight claims and is situated on the east shore of Slocan lake, near New Denver. Two claims have been developed upon each property. Upon the Monitor a total of 3,950 feet of development work has been accomplished to date. The output has been 3,207 tons of crude galena ore for which net smelter returns of $125,268.38 have been received. In addition to this output about 3,000 tons of second class ore have been mined which, after concentration, is expected to produce about 350 tons of lead concentrates and 1,500 tons of zinc concentrates.

On the Bosun the total development measures 4,060 feet and the output, up to date, is 2,920 tons galena and 1,300 tons zinc. The Bosun claims to be the first mine in the Slocan to ship zinc profitably to Europe. That was antecedent to the present operations. The Monitor and Ajax Fraction Company has only recently acquired this property.

The company having a large tonnage of second class ore on hand which could not be marketed profitably, erected a concentrator at Roseberry which would also separate the zinc from the lead ore; the mill is, therefore, a zinc and lead concentrator. The pulverizing machinery consists of one 10 by 20 Blake crusher, a Gates crusher and two sets of 14 by 24 rolls. The concentration and separation plant is a combination of seven four compartmented jigs and sixteen vanners. Besides these there are the usual accessories, automatic samplers, automatic feeders for the rolls and concentrators, trommels, elevators, classifiers, tanks, electric light plant, etc.

The mill is run by water power, the water being conveyed to the mill through an 18 inch pipe under a head of 376 feet. The power is applied through two five foot Pelton wheels.

The sizing and classifying are done by a combination of revolving screens and hydraulic classifiers.

The flow of ore is as follows:—The ore is crushed in the Blake crusher; is then conveyed automatically to the Gates crusher, in which it is ground to a finer size; is then passed through a system of three Snider automatic samplers, one one hundred and twenty fifth part of the feed being cut out for assay purposes and then falls into a large ore bin. Hence it is fed automatically into the set of coarse rolls whence it gravitates into the elevator boot and is lifted to the top of the building. Here it passes into four revolving screens, having 12 mm, 8 mm, 4 mm and $2\frac{1}{2}$ mm holes respectively. Each size passes from the screens, by gravity, into its respective set of jiggers; the undersize passing over three hydraulic classifiers, Culver patent.

This latter is a great improvement over former classifying systems, the particular feature being a cross current of water of regulated force which meets the particles descending through the rising jet and drives them transversely. After passing the classifiers that which remains is extremely fine and is run into a settling tank, 60 feet long, in such manner as to allow of its being classified into 16 sizes, on exactly the principle which is shewn on the settling of sediment to the bottom at the entrance of a muddy river into a placid lake, the coarser particles coming to rest first. From the settling tank these fines are treated over a system of vanners, the vanner in use being somewhat similar to the Luhrig vanner. Here the final concentration of the fines takes place. The overflow of the settling tanks runs over into yet another settling tank in order that any possible residue may be caught. This residue is sold according to its value. It is impalpable and would run through a 250 mesh. The capacity of the mill, under this system, is 90 tons daily.

The products made upon the three classifiers are treated upon three jigs. The products of jigs and vanners are zinc and lead concentrates, the latter being ready for shipment and the former awaits the magnetic separator. The value of the zinc is largely increased by the separation of iron from it. Iron contents in zinc ore or concentrates are penalized by the smelters and, moreover, the separated iron has a certain commercial value as a smelter flux, especially as it contains good silver and gold values.

New Zinc Concentrator at Roseberry, B.C.

The new feature of the process just described is that no tailings are made upon the jigs. Such tailings are treated as middlings and are put through again, the tailings being thus made upon the vanners. This, of course depends upon the mill feed. The concentrates are practically three to two. It is therefore possible, without largely increasing the installation of machinery to run the tailings as middlings. If the mill feed meant a concentrate of 10 to 1, this could not be done, unless the milling capacity were enormously increased and then the point would remain whether the cost of such increase would set off the extra gain made.

In the case under review 960 tons of ore were put through the mill, between October 17 and November 20, resulting in 693 tons of concentrates and 267 tons of tailings. Nothing is being done at present as the ore dump is frozen up. With the run of the mine being used as mill feed and with the magnetic separator erected, the company looks forward next season to a continuous run. The experiment has been made and made successfully, upon the ore dump, without any expense being incurred in the way of mining excepting some ore bins being erected at Three Forks upon the Monitor end of the holdings of the company.

The actual test, according to the mill returns, supplied by manager M. Gintzburger, are as follows:—

Permuting this return it will be found that the recovery of silver was 89%, that of lead, 73% and that of zinc 86½%. The test for gold was not made on the mill feed.

It will be seen by the above figures that the zinc concentrates contain 3½% lead. This lead is not marketable when mixed with zinc ore and in such small quantities but after magnetic treatment the iron separated from the zinc contained from 6 to 7 per cent. lead and is then paid for by the smelters at the usual rate. As the iron contents amount to about 30% of the total weight of the zinc concentrates, i.e., about 160 tons containing, say 6½% lead, or about 20,000 pounds of marketable lead, it follows that the actual commercial recovery in lead is 83%.

Thus a step further will have to be taken in the erection of a magnetic separator to take out the iron from the zinc. Plans for this plant have already been drafted and submitted for approval. the estimated cost being about $15,000. It must, however, be understood in this connection that the recent rise in the market price of spelter has altered conditions of mining. With spelter at £18 the ton no zinc ore running 40% or under was much worth considering. With spelter at £28 the case is different.

There has been some criticism as to the location of the present plant but it is explained by the management that the plant was erected in the first instance with the view of its being made a customs mill. Further the shipping facilities are excellent, either by boat or rail (C.P.R.) The site and the available water power are better at Roseberry than at the Bosun itself, which is five miles distant along the lake. Were the mill at the Monitor, nine miles away, the Bosun ore would have to be taken up hill for nine miles. The cost of the mill was $50,000.

MILL FEED				GALENA RECOVERY				ZINC RECOVERY					
ASSAY				ASSAY				ASSAY					
Tons	Agg. oz.	Pb. %	Zinc %	Tons	Av.	Agg. oz.	Pb. % Zinc:	Tons	Av.	Agg. oz.	Pb.%	Zinc %	Fe.
966‡	20.04 19362½ oz.	10.29 198843 lbs.	23.7 457978 lbs.	156¼	$4.50	54.4 8501 oz.	46.5 10.3 145312 lf	537	$3.60	16.2 8699 oz.	3.5	368	15 395730

THE GEOLOGY OF JELL.*

(By Prof. J. F. Kemp).

It is the custom when we meet at the annual dinner to bring up only those subjects which have not been mentioned at all or which have been but incompletely treated during the regular sessions. I have one to present, about which, I think—I may even say I hope —all who hear me know little, In fact I even find it difficult to discover an acceptable name for it. I will therefore select a pseudonym. One of my old friends in college was a very pious individual named Bill Gosman. His early training had been so strict that he found it difficult in his later years to command a suitable vocabulary with which to relieve his emotions when they became strong and get a series of terms which would not offend his conscience. Finally, however, when these occasions arose, he would remark with deep feeling, Jam the jam thing to Jell.

It is of the geology of Jell which I wish to speak to you to-night and as I have said I am the only one here who knows about it as yet. But impelled by that ambition which every scientific man feels to spend some time in exploring a new district which no geologist had previously seen, and being anxious withal sometime ago to have a striking and novel subject to describe upon an important occasion like the present, I spent sometime in this the only district near New York which had not previously been exhausted by my colleagues, Dr. Clarke, of Albany and Dr, Kimmel in New Jersey, There have been several travellers who have visited it in the world's history. There was Orpheus who went in search of his lost Eurydice. There were Ulysses and Æneas, and in later times Dante. Nevertheless all of these were anything but scientific observers and while they brought back in each case much that was of great human interest, their references to the geology of Jell are of the most meagre character. In fact the references are all physiographic rather than geologic and relate to plains, rivers, gulches and caverns, without telling us whether the plains were wave cut terraces, lake-basins or deserts in origin, or whether the rivers were at base level or not. Moreover they mix up young, mature and old topographic forms in a way which shows that no one of them had any real grasp of the subject. And as for the geology there is almost nothing said. There remains therefore much of deep scientific interest to impart about Jell.

In order to reach Jell you go down to that portion of New York called the Tenderloin and then, as has been long known, you are right at the entrance. You hunt around until you find the mouth or crater of the conduit up through which the Palisade trap reached the surface. This is on the east side of the Hudson contrary to general belief, and from it the hot molten diabase turned westward, but the old connection was

*A paper read at the Annual Dinner of the Geological Society, of Canada, Ottawa, December 29th, 1905:

long since destroyed by erosion. At the entrance, much as if you were going into a North River tunnel, you provide yourself with an asbestos suit so made as to be absolutely a non-conductor. When clad in it one can walk without danger amid the most elevated temperatures. The secret of its composition is known to few, but it was familiar to Shadrack, Mechak and Abednego, the three children of Israel who were in the fiery furnace many years ago. It was also used according to the researches of Professor Pumpelly in Anan, when in periods of excessive aridity the sun at midday made that town as hot as Jell. Its discovery is of the highest importance to one of Canada's leading industries.

The head-piece has small transparent windows of mica very much like a stove door out through which one looks without danger. Inside the back of the jacket is an apparatus containing liquid air for a cooler and as one expires the exhausted oxygen inside the suit, the latter is fitted with an outlet valve so constructed as to let only $C.O_2$ pass, since should any free oxygen escape there would be a frightful conflagration under the conditions prevailing in Jell.

Thus provided and having a topographical map ruled in coordinate squares, a note-book, a compilation book, an infusible platinum hammer, an inside compass, an outside asbestos rock-bag and a sack of condensed food, I set out.

I ought also to mention one other ingenious and essential piece of apparatus. My suit was provided with two sets of thermergons or heat generators, one in front and one behind, each outside the asbestos suit. By turning switches one or both would emit intense heat rays which would be radiated outward and which, as you will see, were necessary to the trip. I also had an electric lamp.

In the easy descent to Avernus at first you pass over a coarse macadam or pavement of a soft, tuffaceous rock, very much subject to alteration, so that with use it loses all stiffness and resistance. It is called goodresolutionite and specimens may be even found among incompleted manuscripts on the surface of the earth. It seems in the local geological relations to be a close parallel with the garnet, reservianite and andalusite of the contact zones which are occasionally exposed to view in the upper world, but it extends a long distance, since at present the centre of heat is far below the surface.

After a short descent upon the goodresolutionite I met the level of the ground water as would be necessary in our local conditions of rainfall. I noted the change in the character of the wall-rock at this horizon, but did not pause, being keen for the larger problems at greater depth. I waded right into the ground water, which was of meteoric origin in this case and for which I felt less regard than is cherished by some geologists Having once gone below its surface a few feet, I turned on the switch of my rear thermergon and at once heat rays were radiated backward boiling the water furiously to steam of pressures only reached at the point of dissociation of the hydrogen and oxygen. The inevitable result was that I was driven forward much as if I had a powerful screw propeller aft. In a very short space of time I passed entirely through the groundwater zone, which, as everyone knows now is comparatively shallow. Mr. John W. Finch, state geologist of Colorado, has endeavored to show that it is about 1,000 ft. My patent log, which I trailed out astern, registered just 1017 feet, which shows the extreme accuracy of Mr. Finch's estimate. Having passed the zone of the groundwater, which I may also remark is practically still and moves so little as to be of no particular geologic importance, I walked briskly downward amid dry rocks, just such as we meet in the depths of the Lake Superior copper mines.

Gradually however I passed to the limit of the zone of possible fractures and found the walls of the passageway closing in and the bottom becoming choked with the spalls and gob which had scaled off under pressure. Moreover the goodresolutionite began to bulge up in the floor just as shales and fireclay creep in the entry of a coal mine. For fairly tough and resistant rocks like our local mica schists and gneisses President Van Hise has calculated that the zone of fracture extends to a depth of 8342.75 meters. While it is difficult to note in a hasty trip at just what point the possible fractures end, yet by adding to the records of the patent log for the ground water, the depth of the overlying vadose region and the records of my pacing survey, checked by a pedometer, I found the depth of the zone of fracture to be 7979.87 meters, or 362.88 meters say about 1100 feet less than President Van Hise's estimate but on the whole corroborating him very well.

The question may arise in your minds as to how I proceeded at all as the zone of fracture ceased, but the solution of this difficulty is really quite simple. As the rocky walls closed in, I turned on my front thermergon at moderate capacity, and my rear one at twice this amount. The powerful heat rays melted the rocks for the space of a few feet around, and the extra heat of the rear thermergon generated from the dissolved vapors and occluder gases a preponderating pressure a tergo which drove me forward at good speed and with small difficulty gradually I traversed the zone of mixed fracture and flowage, and finally the zone of flowage itself. In the end and after passing 41,387.63 meters of the latter I suddenly shot out into an open space and found myself standing upon the pyroclastics which at this point formed the floor of Jell.

You may raise the question as to the possibility of an open space below the zone of flowage, but it strictly follows from physical principles. The zone of fracture ceases because the pressure is so great that cavities are impossible. The rock is squeezed together and compacted as tightly as matter can be. As one penetrates the zone of flowage the matter reaches a point when it cannot be compacted further, and it attains the property of absolute resistance. Below this surface which is roughly spherical there lies the region of no strain, and it is a matter consequently of physical indifference whether the central space is hollow or is filled.

As I found myself upon the pyroclastics which at this point form the floor of Jell. I shut off my thermergons, and in the clear though not bright unearthy radiance that diffused itself everywhere I sought to examine my surroundings. The cavern was a passageway of moderate size which led on to more highly illumed regions beyond. The location was Jell quadrangle, northeast corner, outcrop, igneous and apparently basaltic in nature. Proceeding 721 meters along the passage I found a dike of a lencocratic phyrocrystalline jellynose—striking N.E.—and after that uniform granitoid walls of gehennose, which constitutes the main country rock. So far as my wanderings took me in Jell this was the solid rock and it varied only in that moderate differentiation had produced a greater or less abundance of the several constituent minerals.

Thus we have in the quantitative system dofelic sodipotassic gehennane, and dofemaniac, sodicalcic, gehennane. The rock would furnish some interesting microscopic data but these though valuable for record are always deadly dull in a paper that is read.

I pass therefore to the real questions of interest which may be solved in Jell. These are the origin and production of the several kinds of igneous rocks, and the solution of that puzzling problem the sources of the metallic ores, and more especially the sulphur compounds.

My observations show that the various kinds of igneous rocks are produced under the direction of the Jevil-in-Chief very much as charges are mixed for a furnace. Thus that the materials for the various lavas exist at the centre of the earth there is no doubt. The only point of interest is the form in which they occur. As a matter of fact the following are kept in storage reservoirs in a molten state and under pressure. They can be tapped off as needed and in any desired proportion. There is a reservoir of pure SiO_2, one of Al_2O_3, one of Fe_2O_3, one of FeO, one of MgO, one of CaO, one of K_2O and one of Na_2O. In these there are slight impurities of P_2O_5, Cl, $ etc, but there is also a separate reservoir of FeS_2, mingled with lead, copper, zinc, silver and gold. When the Jevil-in-Chief orders andesite, he issues instructions for the proper proportional parts of these ingredients and the subordinate jevils run them together and over into a spout which connects with the volcanic conduit. Into this and on the principle of the injector, is run under enormous pressure steam and other mineralizers and the whole mixture, boiling and seething, forces its way through the zone of flowage and so to the upper world. At rare intervals the metallic bath is tapped into it, especially during the expiring stages, and then ore deposits result as the igneous action in the upper world draws to a close. But I hear the Secretary of the Society say how can all this be in accordance with the planetesimal hyp. I do not see myself how in Jell it can be, but if carried away by that interesting figment of the imagination the planetessimal hypothesis you question the existence of Jell you contradict not only the testimony of the distinguished travellers who preceded me, but my personal observations and the testimony of all the orthodox divines for centuries.

Time fails me to enlarge upon these topics although as you will see they furnish the clew to much that has troubled many thinkers hitherto.

One other question will arise regarding Jell. Did I see nothing of the various remedial forms of treatment of the wicked which other travellers have noted? I did not, except in one minor case. They generally were given up about one generation ago and passed out of use. The only survival is one for the treatment of wicked cephalopods and brachiopods. Both these groups of organisms are provided with resistant shells into which after evil deeds on the surface they retired with impunity. In Jell the wicked ones have been gathered by thousands into a vast pool of water. First acid is turned in on them and it dissolves the shells to their great discomfort while nourishing the tissues; then alkaline calcic solutions are let in which reproduce the shells while destroying the tissues, and thus alternately these two reactions are carried out until complete repentance is produced and the head Jevil can say "Now will you be good."

I fell into conversation with the Jevil-in-Chief and we discussed many topics of interest. He informed me that among his other schemes for abstracting the water of Niagara he had contemplated sinking a shaft from the head of Goat Island and letting down directly into Jell 222.367 cubic feet per second of both Canadian and American water to use as steam in propelling the eruptive rocks to the surface. But the State Geologist of New York had raised such an agitation against using the waters for other purposes than the manufacture of sarsaparilla and other soft drinks that the subordinate Jevils in the New York Legislature and the Ontario Parliament refused to take his orders. So we parted and regretfully ending this interesting conversation I retraced my steps to the point where I had entered, passed up through the zones of flowage and fracture, through the ground water and vadose region and shot up out of the ground in the Tenderloin. No one paid the slightest attention to me for everyone thought I was just one of the workers in the tunnels under the river who had been blown out by leaky air, an occurrence now so common that it no longer excites remark.

THE COBALT-NICKEL ARSENIDES & SILVER DEPOSITS OF TEMISKAMING.

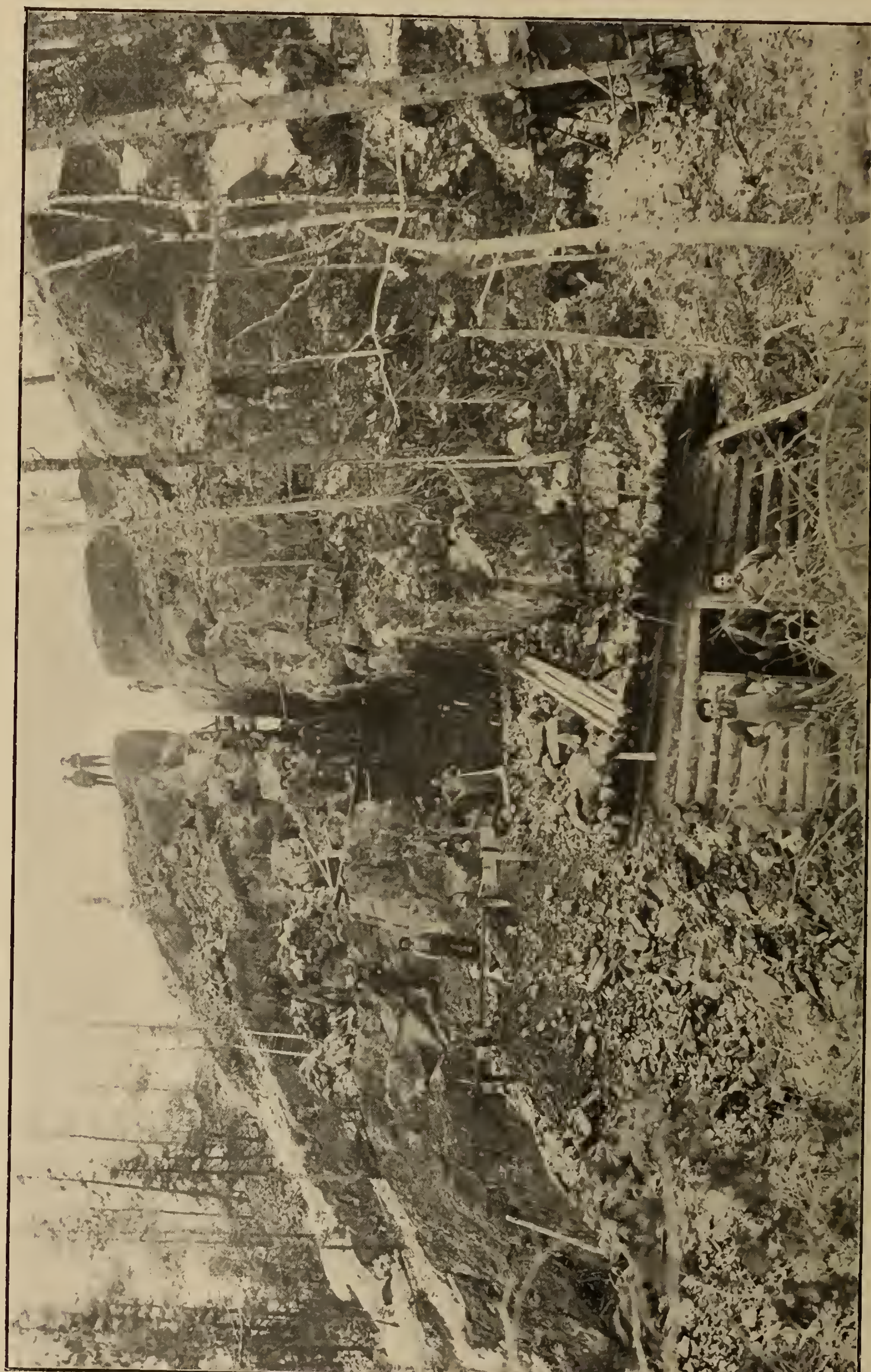
This most valuable and comprehensive report, by Prof. Willet G. Miller, Provincial Geologist of Ontario, constitutes Part II of the Report of the Bureau of Mines for 1905.

We have previously had occasion to congratulate the Ontario Bureau on the practical nature and value of bulletins issued therefrom dealing with the economic minerals of the Province, and from an economic standpoint the present monograph is in many respects the most interesting of the series and is bound to attract a great deal of interest and attention with the investing public.

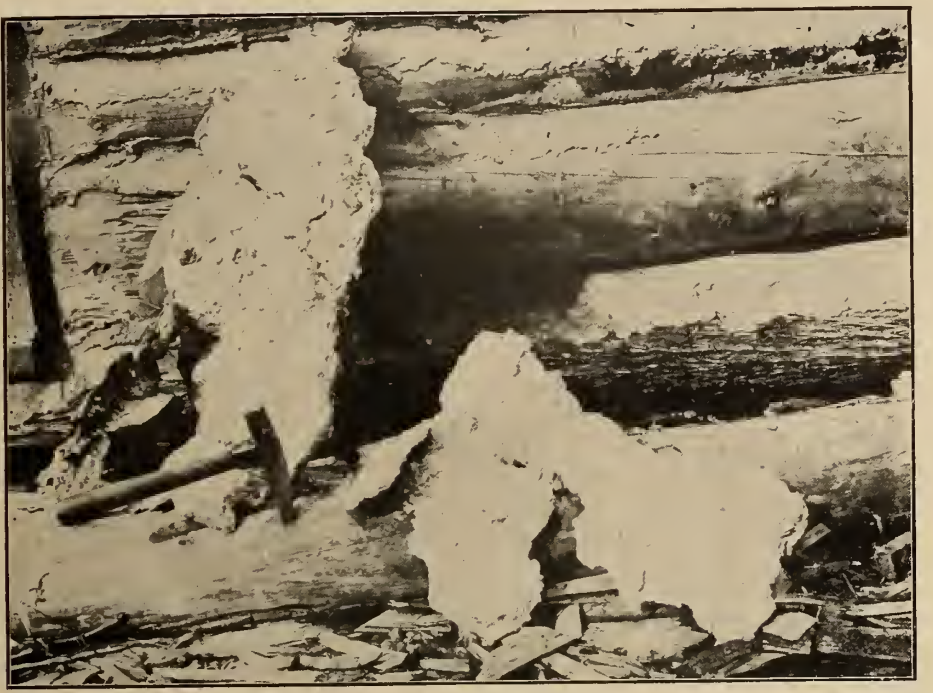
After briefly summarizing the information given in respect to the situation and discovery of the Cobalt Silver Ores in the area, examined during 1904, by the Provincial Geologist, the report states that since then a considerable amount of exploration work has resulted in the further discovery of a number of extraordinary rich deposits.

The deposits at Cobalt occupy narrow, practically vertical fissures or joints which cut through a series of usually slightly inclined metamorphosed, fragmental rocks of Lower Huronian ages.

Mr. Miller states:—"The material in these veins has, in all likelihood, been deposited from highly heated and impure waters which circulated through the cracks and fissures of the crust and were probably associated with the post-Middle Huronian disbase and gabbro eruption. It is rather difficult to predicate the original sources of the metals—silver, cobalt, nickel, arsenic and others—now found in these veins. They may have come up from a considerable depth with the waters, or they may have been leached out of what are now the folded and disturbed green stones and other rocks of the Keewatin. Analyses of various rocks of the area have not given a clue as to the origin of the ores. As these ore bodies in the vicinity of Cobalt station may be said to be unique among those known in North America, we have no chance of instituting comparisons on this continent. Some European veins, however, such as those of Annaberg, Jochimsthal and other localities which will be again referred to, show a similar association of minerals. The origin of these has been explained by most authors by the supposition that the metals were leached from the surrounding rocks. The



The Little Silver Vein, southwest corner of location R. L. 404. The cliff is about 70 feet in height, and is composed of almost horizontally lying Lower Huronian rocks. At the bottom of about 15 or 20 feet of well banded greywacké-slate. This is followed by about the same thickness of feldspathic quartzite, overlying which, at the top of the cliff, is a coarse conglomerate. The greatest thickness of the vein, as originally exposed, was about 8 inches. The strike is east and west, and the dip, as the photograph shows, is almost vertical.



Slabs of silver from the Trethewey Mine, location J. R. 7. The slab standing upright by the hammer is the 79 pound specimen referred to in the text.

Cobalt Hill vein, northwest corner of location R. L. 404. The photograph shows the fractured character of the rock and a gentle anticline. The vein is seen to be in step-like forms as if it had been affected by horizontal faults, but the ore is not brecciated.

writer has found, however, from the descriptions which have been published of most of these European occurrences, that there are usually basic dikes in the vicinity of the veins. These dikes appear to have in some cases the same relation to the ore bodies that those of diabase and gabbro have in the Ontario Cobalt region."

The more immediate ores in these veins are native silver, with smaltite, niccolite, and related minerals. In addition, there are a number of secondry or decomposition products with rather indefinite characteristics, such as asbolite, consisting essentially of the oxides of cobalt, managanese, etc. The cobalt bloom and annabergite occur intermixed, at times, in proportion such that the red color of the former counteracts the green colour of the latter, a white claylike substance being the result. There are occasionally other sulphides present than those mentioned, especially in the wall rock. These consist of copper pyrites and bornite, which are the sulphides of lead; and iron pyrites, the disulphide of iron. Zinc blende is found occasionally. These minerals in the wall rock were probably deposited before the vein minerals.

been so rich in silver, cobalt, nickel or arsenic as those of Ontario.

The five or six productive properties from which shipment have been made during the last few months, all carry, with one exception, high silver values, as do also the veins more recently discovered. During the year, production for the first quarter ending March 31st, during which shipments were made, was 354.05 tons of ore valued at $293,552. The ore thus averaged $829 a ton. The average percentage of the metals in the ore was as follows:—

	Per cent.
Silver	4.802
Cobalt	8.264
Nickel	4.739
Arsenic	34.606

The 4.802 per cent. of silver represents 1,406.27 ounces a ton. The cobalt, nickel and arsenic in one car load are not included, no returns having been made.

During the second quarter, March 31st to June 30th, the shipments were 537 tons, valued at $394,552, or an average of $734 a ton.

La Rose vein.

One characteristic of the group is the subordinate part which sulphur plays in comparison with arsenic. Antimony, which is not abundant, is found in some compounds where arsenic might be expected to be found, since the latter is so much more abundant. For instance, while both native silver and arsenides are present in abundance, no compounds of arsenic and silver have yet been recognized although they are probably present. It would also be reasonable to expect to find some compounds of bismuth, since this metal occurs in the free state in considerable quantities in some parts of the deposits. It might also be expected that native arsenic would occur at times. The report notes that nearly all the chemicals of minerals found in the Joachimsthal deposits of Bohemia are present in the Temiskaming ores. But these Bohemian deposits do not appear to have ever

The average percentage of the metals in the ore for this quarter was:—

	Per cent.
Silver	4.158
Cobalt	6.890
Nickel	3.091
Arsenic	30.912

The metals in the ore were sold at approximately the following prices:—Silver, 55 to 60 cents an oz. Troy for 90 per cent. of the contents, cobalt, 65 cents, nickel, 12 to 15 cents, and arsenic about 1 cent a pound.

During the first quarter of the year, shipments were made from the La Rose mine, the New Ontario mine, from the McKinley and Darragh, and by the Nipissing Mining Company, working the Cobalt Hill and Little

Silver veins in the north-west and south-west corners of R.L. 404, prospectively. At the present time there are probably fourteen or more shipping mines. Ore shipped so far has been sorted by hand, while much ore that in other localities would be considered high grade is accumulating on the dumps. It is expected that in the near future this ore will be milled, and so help materially increase the output of the region. The extraordinarily high grade value of the shipping ore is shown in the statement that on the Trethewey vein $200,000 worth of ore was produced from an open cut 50 feet long and 25 feet deep, the maximum width of the vein being not more than 8 inches. The amount realized from the shipment of one carload of 30 tons of ore from this mine was between $75,000 and $80,000 and the analyses of a shipment of 50 tons gave approximately the following percentage of metal:—Arsenic, 38%; cobalt, 12%; nickel, 3.5, and silver, 190,000 ounces.

Elsewhere in the report reference is again made to the Cobalt Hill vein, which was described in the 13th Report of the Bureau. This vein was one of the four discovered at the time of Professor Miller's visit to the district in Nov., 1903. The ore is described as unique, in that silver is absent, in paying quantities, the values being confined to cobalt, nickel and arsenic.

Following an interesting chapter on the analysis of the ores of the district, is a description of the cobalt-silver veins. Most of those worked have been developed by means of open cuts, but the most systematic development work has been done on the La Rose, where a shaft has been sunk and drifting carried on at the 80 feet levels. It is stated that approximately a million dollars worth of ore has been blocked out on this vein; but this is said to be probably the largest ore body yet found in the area, and Mr. Miller states that it would hardly be correct to infer that smaller veins can be followed as persistently. We quote the following upon report:—

"Most of the cobalt-silver veins occur in the Lower Huronian. A few have been found in the diabase. There is no reason, so far as the writer can see, why the veins should not also occur in the under-lying Keewatin and some of the more recently discovered ones, near the centre of location R. L 404 appear to be in this group. The Keewatin greenstones and other rocks are tougher and do not fracture with the same ease as the overlying series of the Lower Huronian. Hence the solutions have not had the same freedom of movement in the former as in the latter. In so far as the precipitation effects which the rocks of either series may have on solutions working through fissures in them there seems to be little difference between the two. Many of the pebbles and boulders and much of the cement material in the Lower Huronian have been derived from the under-lying Keewatin. Hence one would think they would have about the same influence in precipitating substances from solutions as the rocks of the latter formation. The distribution of the Lower Huronian, as will be seen from the map, is irregular. At one time, in all likelihood, it formed a complete layer or mantle over the uneven surface of the older rocks. This has been removed to a considerable extent by erosion, leaving the rocks now in more or less isolated belts and patches.

"The more important veins so far found in the Lower Huronian lie in what may be called three parallel belts. Those first discovered are in a belt which runs about parallel with the railway in the vicinity of Cobalt lake. A small belt connects the northeastern corner of Peterson lake with the northwest corner of Cross lake. A third belt stretches from Giroux lake to the southeast end of Cross lake, in which important deposits occur. Although these three belts have a strike approximately in a northeast and southwest direction, the strike of the veins is not uniform, as will be seen from the plan. Those on J B 7, J B 6, and on the location immediately southwest of the latter claim strike east and west. The veins on J S 14 and J B 1 strike approximately northeast and southwest, while that in the northwest corner of R L 404 strikes northwest and southeast. The vein in the southwest corner of this location strikes east and west, which is the direction of strike of the majority of the veins.

"None of the veins are wide. The width of ore in the Trethewey vein on J B 7, for instance, had a maximum width of about 8 inches, while the vein in the northwest corner of R L 404 has 14 inches of ore and that on J S 14 showed about 18 inches . Some veins which have been traced 100 feet or more average not more than one inch in width. The surface, being uneven and more or less covered with loose deposits and with green timber, does not afford an opportunity of tracing the outcrops of the veins any great distance, and it is not known definitely how long most of the outcrops would prove to be if the material referred to were removed from the surface of the solid rock.

"It is also impossible to give much definite information concerning the depths to which these veins will reach. Most of them do not appear to cut through the older Keewatin series which forms an uneven surface below the Lower Huronian. In the vicinity of Cobalt station the latter rocks are found on hill-tops which stand about 500 feet above the low water level of Temiskaming, where similar outcrops are found.

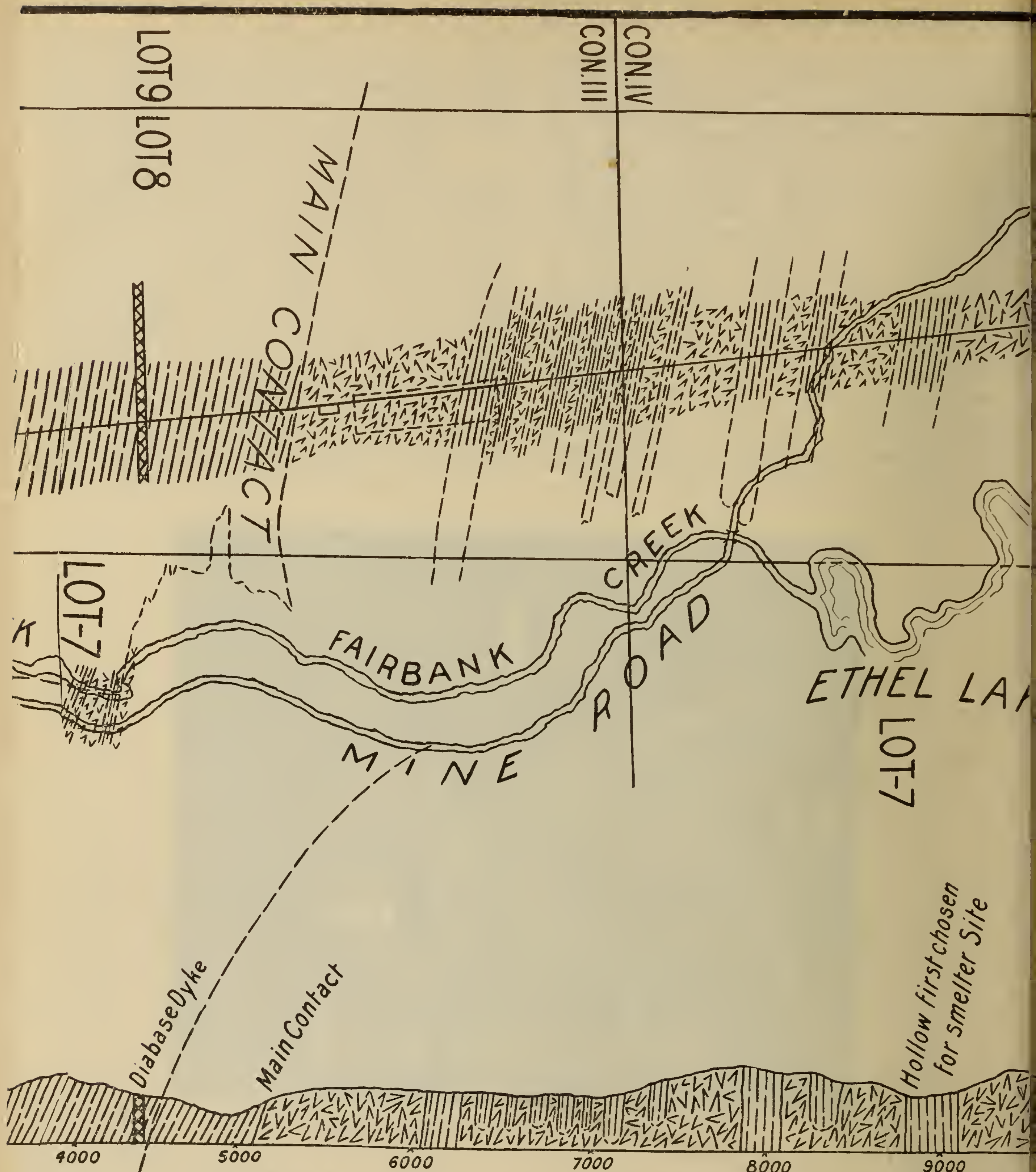
"The depth to which a vein may reach depends, therefore, on whether it descends into an old valley of the older rocks or whether it lies above a former hilltop. No one can tell this of course without diamond drilling or sinking a shaft. Evidence of the probable thickness of the Huronian or vein-bearing formation can, however, be determined by noting the outcrops of the Keewatin or the intrusive diabases. An exposure of Keewatin surrounded by the Lower Huronian represents an old hilltop. It is therefore evident that a vein which strikes towards this outcrop is likely to have a less depth near the outcrop than some distance away from it. Similarly, if a diabase dike or mass cuts through the Lower Huronian in a vertical direction we have evidence of a greater depth in an adjacent vein than if the diabase cut through the Huronian at a lower angle. In the latter case the vein may be disconnected or cut through by the diabase at no great depth from the surface. Examples of both of these occurrences can be cited in the field. It is likely, however, that in some cases, at least, a vein passing downward through Lower Huronian conglomerate or slate will penetrate sheets or sills of diabase which it may encounter. Similarly veins starting at the surface in a diabase sheet or sill will likely penetrate underlying conglomerate or slate, judging from what we know of the veins of the Port Arthur district were the diabase bears a similar relation to the fragmental series."

There are three or four exceptions to the statement that the veins occur in the Lower Huronian, thus at the northwest corner of Cross lake silver and associated metals have been found in diabase, and also, in the Township of Dymond, cobalt bloom has been found in the diabase. Veins have recently also been found in the diabase on the Handy and Jacobs locations, this latter being the chief producing mine in the diabase.

Trethewey vein and discovery post, J. B., 7, May, 1904.

The area so far productive in the Cobalt region is shown on the geological map and plan accompanying this report, to be covered by a rectangular with a length of 2½ miles in a north and south direction, and a width east and west somewhat less. The chief properties in the northwest part of this rectangular are in the vicinity of Cobalt lake and the railway, and another important group lies immediately south of Glen and Kerr lakes, in the southeast of the rectangular.

The system of water courses in this district is a remarkable one. The chief watercourses follow either a northeast or southwest, or northwest and southeast direction, the latter being the more prominent. Con-



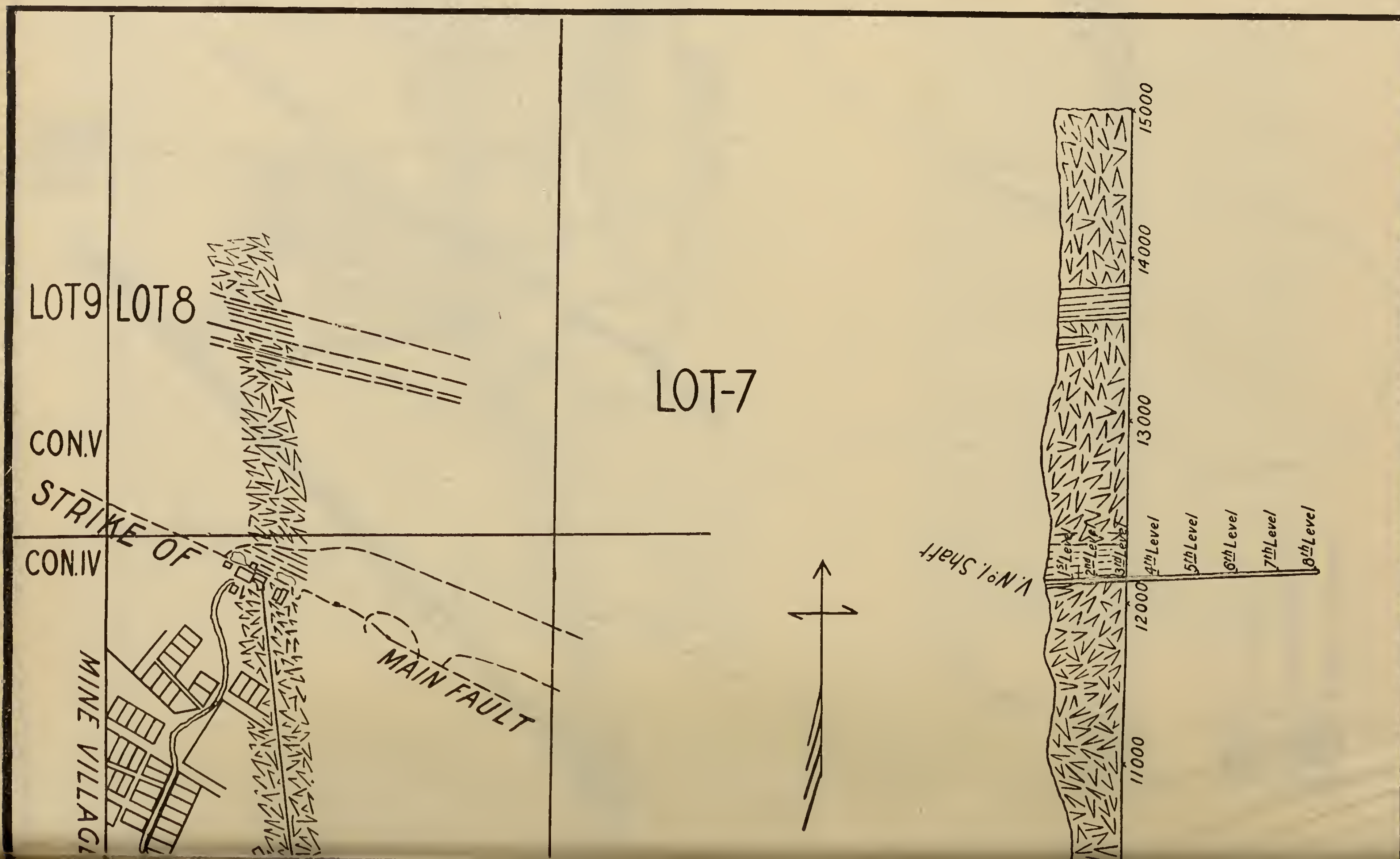
GEOLOGICAL PLAN AND SECTION

ALONG TRAM LINE

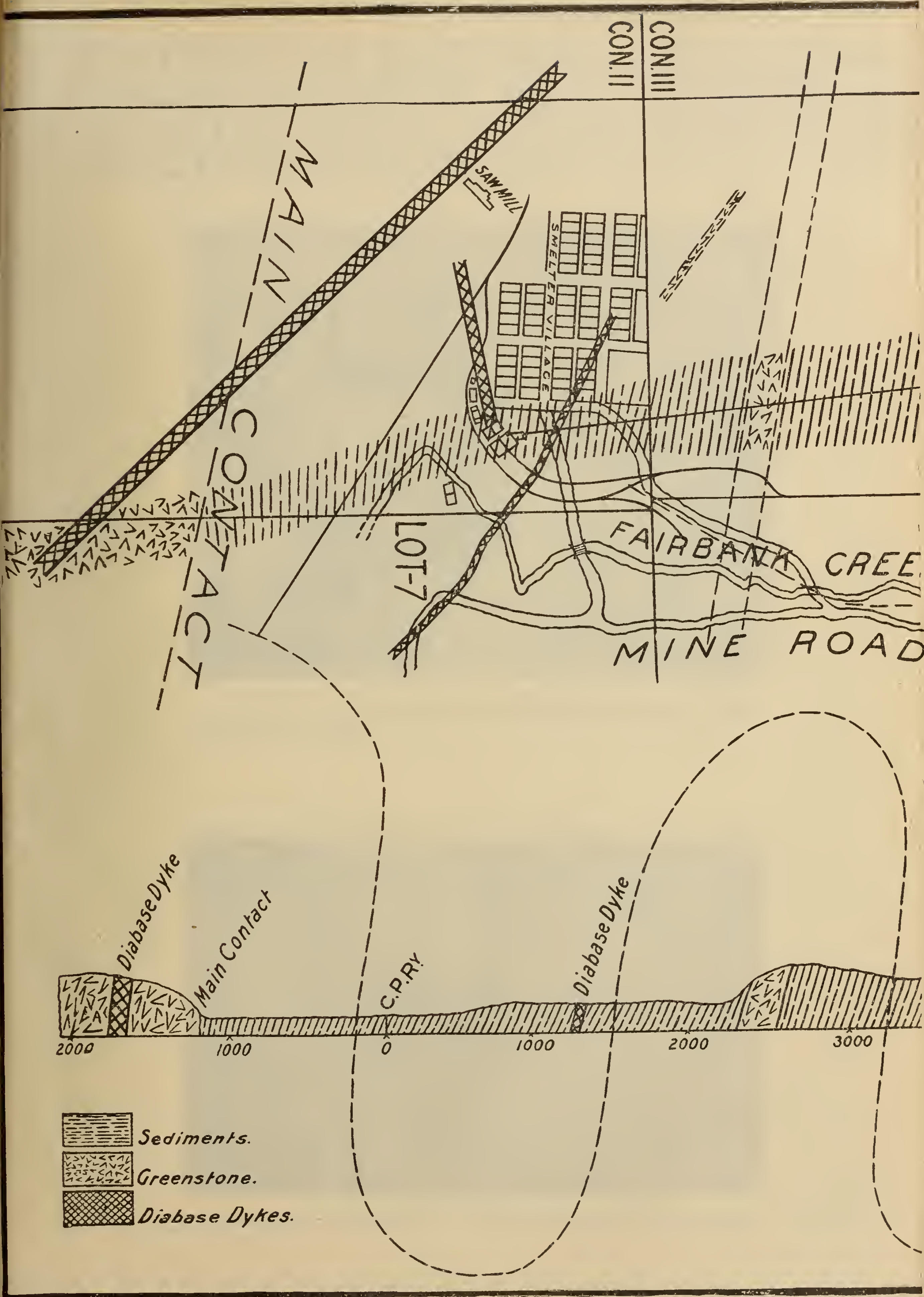
AT

VICTORIA MINES

VERT. SCALE 320'=1"
HOR. SCALE 800'=1"



LOT9
LOT8
CON.V
CON.IV
STRIKE OF
MINE VILLAGE
MAIN FAULT
LOT-7
V. No. 1. Shaft
1st Level
2nd Level
3rd Level
4th Level
5th Level
6th Level
7th Level
8th Level
11000
12000
13000
14000
15000



CON.II
CON.III
MAIN CONTACT
SAW MILL
SMELTER VILLAGE
LOT-7
FAIRBANK CREE
MINE ROAD
Diabase Dyke
Main Contact
C.P.RY
Diabase Dyke
2000
1000
0
1000
2000
3000
Sediments.
Greenstone.
Diabase Dykes.

cerning the origin of the two great systems of water courses, little information is at present obtainable, thus it is impossible to say whether the courses follow fault lines or simply folds. They have, doubtless, been due to regional disturbances in the post-Middle Huronian times. Much of the surface of the country is covered by recent and glacial deposits, and the exposed rocks present a complex of igneous and metamorphosed fragmental material with the minor faults and folds, and that it will be difficult to prove the existence of what may be called regional faults or folds.

The report also deals with Lake Superior silver deposits of the silver mines in the area adjacent to Port Arthur. There is also a chapter on other Canadian nickel-cobalt ores, and a brief account of foreign cobalt deposits.

Vein showing on the wall of a pit at the La Rose mine November, 1904. The width of the vein is equal to the space between the head of the hammer and the man's hand on the handle.

A typical silver-cobalt vein on J. B. 6. The head of the hammer shows the width.

THE BEARING OF ENGINEERING ON MINING.

With Especial Reference to Mining Education.*

By Prof. J. B. Porter, Hon. D.Sc.

Lord Milner, in his altogether admirable book on Egypt, has much to say of the work done by engineers in reclaiming and developing that wonderful country. He refers, of course, to the men of our day and generation who have laboured, and are still labouring, to control the Nile, to economise and distribute its waters, to build railways through the desert; in a word, to carry to successful completion by modern means public works most of which have been proposed, or at least dreamed of, since the beginning of history.

The book does not concern itself greatly with the past but incidentally it tells us that in ancient times "Egypt had very good engineers," who did great deeds. On other pages misfortunes and failures are clearly laid at the doors of those in authority who have from time to time failed to make proper use of the available resources of engineering science.

The great thing about the book as a whole is its masterly presentation of the advantages of British influence, of honesty, order, and commonsense in government; but to an engineer its secondary thesis is of even greater personal interest: the absolute beneficence of engineering works in the development and utilisation of natural resources.

I have referred to Egypt because there we find the remains of perhaps the earliest of all engineering work, there we see some of the most interesting and one of the most notable achievements of the last century; and, finally, because there we have just completed one of the grandest and most directly beneficent works of modern engineering. Egypt thus shows us in a very clear and simple way what the engineer has done for the good of mankind; but the same story may be read in every part of the world, and, to my mind, it is one of the greatest stories of modern times.

I do not wish to make light of the great work that is being done in other departments of science, or even to weigh one branch of knowledge and one kind of effort against another, but I do believe that none possesses greater interest, none is more honourable, none is of greater use to the nation or to the world at large than engineering.

The influence of engineering in mining is but one case in the general proposition just stated, and though probably not as important as those of several other branches of engineering development, its aggregate importance is immense.

Mining has been one of the world's great interests from very early days; but until recent years it had been so uncertain that its development has been greatly retarded. The discovery of the mineral was in nearly all cases a matter of chance; mining, owing to difficulties of pumping, hoisting and ventilating, was usually on a small scale, and often most hazardous and costly: As a result, profitable operations were confined to rich or favourably-situated ores and coals, and quite too frequently enterprises failed when apparently well under way, owing to some unforeseen mischance, or to the loss or decreased value of the ore body. Chance still plays a great part in mining, but it is no longer the ruling influence. The first discovery in a new region is still usually fortuitous, but it is promptly followed by good scientific work. Government surveyors map out the district, and its geology, in a broad way, and private mining geologists direct the detailed prospecting. Modern appliances, of which the diamond drill is by far the most important, make it possible to explore to any necessary depth with celerity and economy, and thus the size and value of the ore bodies can be approximately determined before extensive mining operations are begun.

Mining proper, deferred until these preliminary explorations give it justification, can now proceed with almost as great certainty of success as any other branch of engineering; and thanks to high explosives, rock drills, and all the modern appliances for hoisting, pumping, ventilating, etc., the operations can proceed with such rapidity and certainty, and with so little danger, that large outputs can be produced at a cost per ton that is usually a small fraction of what it was a generation ago.

These improvements in methods and reductions in cost have played a great part in the development of our modern material civilization. In ancient times, and even until less than a century ago, gold and silver, and perhaps also gems, were the chief products of mines. Now, in spite of an increase of many fold in the output of these materials, in spite of such mines as we have seen within the last few days—producing more gold and gems themselves than did the whole world fifty years ago—these precious metal industries form but a small part of the work of the miner, whose high duty it now is to produce the main part of all the structural materials of modern engineering, and the coal which has become the almost universal fuel of the present day. The wealth of a country still depends to a great extent on its agriculture and on the number and thrift of its people, but place as a world Power can be better measured by its production of coal and iron.

This great development of the mining industry that I have briefly indicated has been largely due to improvements in general engineering, and to the opening up of new districts and to the creation of new or increased demands for material; but those in charge of the actual underground operations deserve a full share of praise, for, in addition to original work on their own account, they have been keen to seize upon each new invention that could be turned to their uses.

Gunpowder was used (I believe first in the mines of Saxony) long before the disappearance of plate armour. Nitroglycerine and its compounds, invented little more than a generation ago, were promptly accepted by mine and tunnel engineers, and were extensively produced at the mines themselves before they were commercially procurable elsewhere.

I need only name Watts to remind you that his inventions were primarily made on behalf of mining. Tramways were laid in mines as soon as on the surface. Cable haulage was used in scores of collieries before it appeared in the streets of even the most progressive of the American cities. The electric tram was, I believe, first used on the surface; but one was in successful operation fully sixteen years ago underground, and to-day there are thousands of miles of underground lines, with an enormous aggregate tonnage, operated by the most recent of means.

I had intended to illustrate this development of mining at some length by means of slides, showing the changes which have taken place in methods and appliances, but, unfortunately, the slides have failed to reach me, and I shall, therefore, illustrate only one branch of mining, and only one group of mines. The mines at Kimberley are, however, almost ideal for my purpose, and afford a wonderful, yet typical, illustration of the progress of the art of mining. Thirty years ago the methods employed here were as crude as possible. The district was new and inaccessible, and

*A lecture delivered before the British Association at Kimberley, South Africa, Sept. 6th, 1905.

methods abandoned half a century before in more favoured places were the best that could be employed. The great wealth of the district soon, however, attracted a large population which in turn brought about rapid development, able men took charge of the work, and to-day the mines at Kimberley are thoroughly modern in every way, and in some respects set an example of high achievement to the whole world.

In mining operations we rarely produce a material pure enough as it comes from the pit to be of immediate use. Coal and iron ore are sometimes fit enough, but even they are usually sorted, and often elaborately washed before they go to the consumer. Nearly all other ores contain comparatively little of the valuable mineral—say, 2 to 20 per cent. in most ores of lead, copper, zinc, etc., and the merest fraction of a per cent. in the ores of gold and silver. In extreme cases the proportion is amazingly minute. Gold ore from the Rand averages little more than one-third of an ounce per ton—which means that it contains about one part of gold to 100,000 parts of worthless rock, which have to be crushed, separated and disposed of before the gold can be utilized. In some gold mines where conditions are very favourable one-six-hundred thousandths of gold can be profitably treated, and in certain gold gravels in California and Australia one part in fifteen millions has been known to pay operating expenses. These cases are the extreme results of large-scale work with most modern appliances and methods; but they are all surpassed here in the Kimberley district, where, I am told, there are mines which are, or at least can be worked at a profit on so low a recovery as one-tenth of a carat per load. A carat weighs a little over 3 grains and a load of blue ground weighs 1,600 lbs. One-tenth of a carat per load is therefore one part in about forty million. The average richness of the blue ground is greater than this and may perhaps reach one part in ten million, but even this recovery is lower than that of any other profitable mining enterprise, and the first mentioned figure of one in forty or perhaps million is the extreme achievement in this direction of the mineral industry, and literally surpasses the proverbially impossible task of finding a needle in a haystack.

It is, of course, the exceedingly great value of the diamond which makes it possible for mines to handle so much worthless material in order to get the little particles of precious stuff, but this fact does not lessen our interest in the operation, and the concentration practiced here may well be considered one of the most remarkable achievements of modern mining engineering.

The Kimberley mines are also giving us admirable engineering in other directions. Their arrangements for hoisting and handling material are very good and for several years they have held the world's record for maximum output from a single shaft, in spite of the efforts of mines and collieries in many lands. They have also developed and modified the old system of mining by caving and filling to a degree of perfection, which, all things considered, is most remarkably safe, economical and rapid.

I have a series of slides, which I will now show, depicting the gradual advancement in connection with local mining engineering from the earliest days of the Diamond Fields up to the present. (The views comprised a fine series illustrating admirably the developments referred to, and were received with applause. Referring to the picture of the De Beers Workshops—the last of the series—the lecturer said: "The De Beers Company buy their machinery at the places where it is manufactured when it is possible to do so to advantage, but they make their own repairs, and do a lot of engineering work in the shops you see depicted, including the making of big guns when necessary.")

It would be easy to give other illustrations of mining development, but enough has been said to show that the men in charge of our mineral industry have been alert, and have not failed to keep pace with engineers in other lines of work. The full measure of what they have done can perhaps be best shown by a few approximate figures.

Table of approximate tonnages and values of minerals produced in 1903-4:—

Name	Tons of Ore.	Value of Crude Ore or Metal.
Aluminium	15,000	£ 1,025,000
Antimony	200,000	500,000
Arsenic	50,000	100,000
Asbestos	50,000	250,000
Asphaltum	600,000	1,300,000
Baryta	220,000	250,000
Bauxite	149,000	100,000
Chrome Ore	100,000	250,000
Coal	882,000,000	220,000,000
Copper	4,000,000	35,000,000
Diamonds	5,500,000	6,000,000
Feldspar	80,000	200,000
Furnace Fluxes	30,000,000	10,000,000
Gold	50,000,000	70,000,000
Graphite	77,000	1,100,000
Iron	100,000,000	110,000,000
Lead	10,000,000	11,100,000
Manganese	2,200,000	2,200,000
Mercury	200,000	900,000
Nickel	400,000	2,000,000
Petroleum	26,000,000	4,800,000
Precious Stones (ex-diamonds)	1,000,000	1,200,000
Phosphates	3,500,000	3,000,000
Salt	12,000,000	6,000,000
Silver	5,000,000	18,500,000
Sulphur	500,000	2,100,000
Zinc	2,000,000	13,000,000
Totals	1,135,832,000	520,875,000

These statistics might be elaborated, and pointed with illustrations and descriptions of old and new methods of mining in such a way as to make a very interesting lecture; but there is little to be gained by dwelling longer on this part of our theme.

Engineering, or specifically, mining engineering, has played a great part in the development of the world's resources, but the work is but begun. Our mines have barely scratched the surface of the earth; our engineers have developed the merest fraction of its total resources. If the signs of the times are true, we may safely say that the engineering age has just fairly begun, and that the developments of the future, especially in beneficent use of natural resources, will inconceivably surpass anything we now know.

In view of what I have just said, it is our plain duty to see that the young men who are to be the engineers of the next generation shall be as fit as possible for their great task. Until, say, two generations ago, engineering work of all kinds in civil life was done either by military engineers, by men educated in pure science, or by men trained on the works and often lacking any but the most elementary schooling. None of these men were properly educated for engineering in the modern sense, but on the other hand an unusual proportion of them were beyond doubt especially fitted for their work by temperament or circumstances. This fact is evident from the high average of ability and of single-minded devotion shown by the engineers of that time.

(To be continued next month).

SOME SUGGESTED AMENDMENTS TO THE YUKON MINING LAW.

(By J. B. Tyrrell.)

Premising that placer mining in the Yukon Territory is very different from placer mining in any other part of the world, and that therefore the Mining Laws, to be suitable here, must needs be different from the mining laws of other countries:—

Free Miners Certificates.

Every man in the Yukon Territory is living directly or indirectly off the product of the mines in the country. If the money paid for Free Miners' Certificates is urgently needed by the Government as a means of increasing the revenue, every man in the Territory should be obliged to take out such a certificate for the tax should be equally levied on all, irrespective of whether a man is a direct producer or not. If the money is not urgently needed for revenue purposes, and whether it is needed or not, it certainly should not be levied as a tax on a particular industry, and that the vital industry of the country.

The necessity of obtaining such a certificate means a considerable loss of time to every prospector and mine owner in the country; but more than that it means that no man, no matter how favourable the conditions surrounding him, is at liberty to prospect, and stake a claim, unless he has already provided himself with a certificate giving him a right to do so. It is thus a direct discouragement to the old prospector by taking money from him when he needs it most, it prevents hunters, trappers, etc., from prospecting for if they discovered precious metal some one else would be very likely to stake the ground before they would be able to go and get a certificate and return to the ground, and in general it engenders the feeling that it is useless to prospect unless definite arrangements have first been made with the Mining Recorder. Had such a regulation been in force in the Western States during the past fifty years it is certain that the discovery and development of their mines would have been greatly retarded.

Placer Mining Claims.

All claims should be of the same size, and should be as nearly as possible square, so that the direction and character of the "pay," and the location of a claim on a main stream, on its tributary or on no stream at all would make the least possible difference. In staking such a claim most men will comprehend and define its shape and extent much more clearly than if it is longer in one direction than in the other.

In regard to the size of such claims, considering the tenor of most of the gald-bearing ground likely to be discovered in the Yukon Territory, and the expense of installing efficient machinery on it, one thousand (1,000) feet square seems to be a reasonable size, and this is the same area as the creek claims under the present regulations. But the question of the size of claims is one involving a discussion of whether the land should be divided up among very many owners, or whether it should be held by fewer owners who would probably mine more systematically, and I shall not take up that matter here.

In order to encourage exploration and prospecting, a discoverer should be allowed to take a larger block of ground than the above, say two claims long and two claims wide, for the discoverer has an inherent right to a reward for his successful search, while the stampeders or subsequent locators and those who profit by the enterprise of the discoverer have only such rights as the State sees fit to give them, with the view of furthering the development and best interests of the country. It should here be borne in mind that the successful prospector, the discoverer of valuable mineral, is the cheapest and most efficient immigration agent that the country possesses, and that the country is bound to profit by his discovery, no matter how rich a strike he makes.

If oblong claims such as those defined under existing mining regulations, namely 500 feet long and 1,000 or 2,000 feet wide, are continued, a well defined base line on the creeks is almost a necessity to avoid great confusion, even though it may be an expensive expedient. However this base line should be merely directive as to the course of the boundary lines of the claims, and should not determine the positions of the claims themselves, as it does at present. For instance a man might stake a creek claim on some of the creeks in the Klondike district, be given 1,000 feet on each side of the base line as provided for by the present regulations, and still the creek would not be on his claim at all, but would be a long distance away to one side of it. If a man stakes a creek claim, or any other claim for that matter, he should be allowed to choose where the middle line of that claim would be, irrespective of the distance of the base line on one side or the other from him. His Number 1 stake would govern the position of this middle line, which would then be run from this stake parallel to the base line in a general direction towards his Number 2 stake. From this middle line, and at right angles to it, his claim might then extend 500 or 1,000 feet as was thought advisable. A man would thus be given only such ground as he wanted, and in which he had confidence, and which he would be likely to thoroughly prospect.

Disputes.

Disputes as to the location and boundaries of claims should be decided by the Gold Commissioner on the ground, where the parties to the disputes would be able to explain and point out the conditions clearly and fully. Had this been the case in the past, ninety per cent. of the litigation with which this country has been cursed would have been prevented, and litigation means waste of time, energy and money, three things that are so necessary for the opening up and development of the country, and perhaps worse still, it engenders a feeling of utter despair in the possibility of free and unhampered work and progress.

On this point I cannot do better than quote from Mr. J. H. Curle, the eminent Mining Engineer, who spent part of the summer of 1901 in the Klondike district, and who in his book "Gold Mines of the World," writes as follows:—"The Gold Commissioner, his "assistants, and the Claim Inspectors, seem to have no "power—or to be afraid to use it. Their only remedy "is, 'Oh, take it into court.' Dawson, as a conse-"quence, reeks with lawyers and litigation. A couple "of Australian mining wardens, of the old school, who "would ride up the creeks themselves, interrogate the "parties to a dispute, and settle the matter on the "spot—sticking the boundary and water-right pegs "into the ground themselves, and warning the men to "touch these at their peril—would do more good than "the dozens of officials there now, and would soon "empty the courts of litigants."

Representation or Assessment Work.

After a claim has been granted to a man, he should be allowed the fullest liberty to work it as he may see fit, consistent with the freedom of his neighbour. Some men are slower at determining the best methods of working their ground than others are, or they may work slower than others do when they have determined on a method, preferring small profits to financial ruin, even if the latter is accompanied by the applause of the multitude. However, they are not necessarily poorer citizens on this account, and if the value of a citizen is to be determined at all by his willingness to remain in the country and become part of its population, working carefully and conscientiously all the time, rather than by the rapidity with which he is able to seize on some rich prize, and carry it off to enjoy elsewhere, he should be encouraged or at least protected in such careful work as he is trying to do, and should not be continuously urged to join the rush, and get out of the country as quickly as possible. The town of Dawson and the Klondike district in its vicinity, if carefully nurtured, may form a nucleus for the development and settlement of the whole of the surrounding portions of this vast territory, whereas if the enterprise of the country, namely mining, is forced onward regardless of cost, this camp is destined before long to dwindle out of existence, and the Yukon Territory must then look for its re-opening to the overflow from our great neighbour across the International Boundary Line.

Nothing will conduce more to the stability of the population than to give to each man a right, after he has opened up and developed a piece of ground, to live on it and hold it as his own, so that even if his claim should cease to be remunerative if worked under present conditions, he may have a home to which he can return when he is not employed elsewhere without let or hindrance from anyone; without being obliged to report to the Government annually or at any time his whereabouts; and without being subjected to the possibility of change tenure from year to year.

If this view is correct, rather than the one that the State is very anxious that any gold in sight should be taken out of the ground as quickly as possible, or in a mining sense that the country should be gutted at once, regardless of the development of its ore reserves, the annual assessment work, of the Government valuation of $200.00, necessary to be done and proved before the Mining Recorder each year, before a renewal of a mining claim can be obtained, has dwindled to an absurdity.

On developed mining property it is simply an unremunerative vicious tax, which is all used up in the collecting, from which the Government receives no revenue, and which does not contribute to, or assist in, the permanent settlement of the country. A man owning valuable developed mining property should not, and in most cases will not, be diverted from the plans and methods that he has determined on for the operation of his mine by a tax, however absurd, of two hundred dollars a year.

On undeveloped mining property the assessment work, as provided for under the present Mining Regulations, has rarely, if ever, increased its value, either to the individual or to the country. Residence on such property for a certain length of time each year might reasonably be demanded to encourage settlement, and as an evidence of good faith, but after this good faith has been shown, by the doing of a reasonable amount of development, a title should be given which would be free from all restrictions and interference.

In both cases the present perpetual tax of two hundred dollars a year should be done away with.

Title.

There is very little need of emphasizing the necessity for better and less hampered title to mining ground than is now given to holders of mining claims. The exploitation of the Alluvial and Bench gravels of the Klondike has already needed a rather heavy investment of capital, but the time has now come when still heavier investments are necessary if the low-grade gravels are to be worked at a profit. The money for these investments must be looked for in the money markets of the East, where it can be obtained at a low rate of interest, but before it can be obtained at all a satisfactory title to the ground must be produced. I have no hesitation in saying that of late years the lack of an apparently secure title has been the greatest bar to obtaining money for investment here in large mining enterprises.

Besides, if absolute titles were given to mining properties, there would be no necessity of granting concessions or special privileges to any one, for in that case capital could be obtained for the working of a group of claims on any desired scale or by any method.

Freedom of Action.

No reason suggests itself to me why a miner should not be as free from continuous paternal Government control as a farmer or any other citizen. If he were so freed, in this country at least, he would soon lose his reputation as a kicker and would drop back into the position of a quiet unobtrusive man who attends to his own business. He should be treated as an independent and honest man until he is clearly proved to be otherwise. There is probably nothing more humiliating to him than the necessity of constantly appearing before the wickets of the Government offices to submit his statements to the adjudication of the clerks there employed, and often to receive tardily as favours what he knows that he can demand as his rights. The laws are intended for his benefit, and not for his hindrance, annoyance and humiliation, and other things being approximately equal he will go where he will not be so humiliated.

In conclusion, I would add that the best laws in the world may be formulated, but unless these laws are administered with impartiality, integrity and promptitude they will be of little value in promoting the welfare of the community.

NOTES ON SOME RECENT EXPERIMENTS*

On the Magnetic Concentration of Iron Sands from The Lower St. Lawrence.

(By John F. Robertson, M. Sc., S. Can. Soc. C.E.)

In attempting to use the iron sands from the lower St. Lawrence in a blast furnace, three difficulties are met with:—

First, the low percentage of iron on account of the dilution of iron bearing minerals with ordinary sand.

Second, the presence of an amount of titanium much greater than that usually considered permissible in an iron ore.

Third, the fineness of the material.

The third difficulty can be overcome by briquetting and may be left to the metallurgist. This note deals only with attempts to cheaply overcome the first and second difficulties.

The apparatus used in the experiments described below is of special design based on the Heberli drum separator. It consists of a thin hollow brass cylinder about eight inches in diameter and six inches long, revolving loose on a hollow axle through which wires are passed to a set of eight electro magnets arranged

*From a paper read before Mining Section Can. Soc. C.E., Nov. 30th 1905.

radially around the axle, and together filling one-half of the drum. The pole pieces just clear the inside of the brass cylinder. Each has a width of $\frac{3}{4}$ to $1\frac{1}{4}$ inches as desired, perpendicular to the axis, and a length of about six inches parallel to it. Each magnet is wound are with fifty-five turns of insulated wire, and the wires led out through the hollow axle to a connection board so arranged that the magnets can be connected in series, or parallel, and each can be given either north or south polarity. In the experiments described below, the magnets were all in series, with alternate polarity thus: N-S-N-S-N-S. The magnets do not revolve with the cylinder, but may be set to cover any 180 degrees of its circumference desired. The sand is fed to the machine from an adjustable hopper which can be placed in different positions so that the feed can be run in at the top or at any part of the side of the revolving cylinder. Fig. 1 shows a photograph of the whole machine and Fig. 2 two sectional elevations of the cylinder.

The advantage of having the magnets of alternate polarity is that the little grains of iron are turned end for end in passing each magnet. As there are eight magnets, the grains of iron are reversed six or seven times, and in trying to arrange themselves to suit the magnetism of the various poles they liberate the grains of sand which might otherwise be entangled in a bunch of grains of iron and thus be carried over into the finished product.

The apparatus was designed to be run either dry or wet and the drum can be rotated in either direction and at a great variety of speeds.

Fig. 1. View of Apparatus.

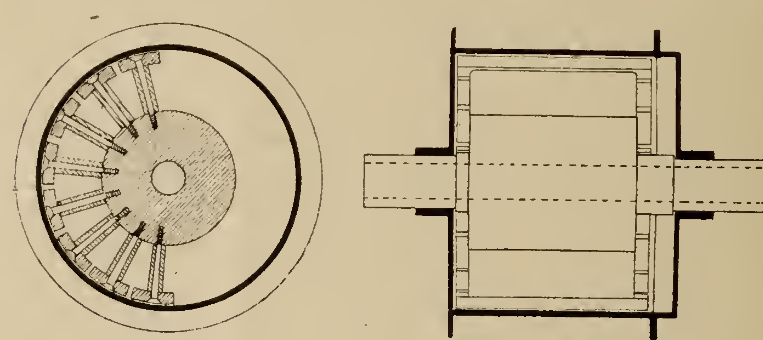


FIG. 2.

Sectional Elevations of Separator.

In concentrating dry sands, the machine is run as in Fig. 3, the sand being fed near the top of the revolving cylinder. The non-magnetic material is collected directly under the edge of the cylinder, while the iron pulled radially by the magnets and moved by the cylinder, passes under the latter and falls off on the other side.

When working with wet sand, the cylinder is rotated in the opposite direction, and the sand fed against the side about half way down. The sand, with some water from the jet A (Fig. 4), reaches the cylinder at B. That part of the cylinder is moving upwards, and the friction of the magnetic material as pulled by the magnets is great enough to carry it with the cylinder against the stream of water from the jet C. The non-magnetic minerals, not being attracted, are washed down and away. D and E are two water jets to clean the cylinder from any materials which tend to adhere beyond the proper points for discharge.

It was found that the co-efficient of friction of magnetite on brass is so low that the grains tended to accumulate in rows in front of each pole piece. This difficulty was overcome by placing a few strips of electric tape across the drum parallel to the axis. Covering the drum with canvas was also tried, but while this gave good results in dry concentration, it carried too much non-magnetic stuff when run wet.

The magnetic field utilized in the separator is the stray field. As first designed, the gap between the pole pieces was made quite small, with the result that a large current was required to produce a sufficient strength of stray field outside the cylinder. The gap was then widened, giving better results. It is now proposed to further increase the air gap between the pole pieces, and enclose the whole working side of the apparatus in an external shield or armature. This will cause a stronger and more even field to pass through the drum, or will make it possible to secure the present strength of field with far less current.

As preliminary work, several field strengths were tried, the weakest used gave practically no concentrates, while the strongest took out nearly all the titaniferous material as well as the magnetite. As magnetite has a much higher magnetic permeability than ilmenite, there should be some strength of field at which the heads product obtained contains almost all the magnetite and still very little ilmenite. Unfortunately grains of ilmenite cannot be distinguished by the eye from grains of magnetite and assays for titanium in the heads and for iron in the tails should have been made to show what were the limiting amperages for successful concentration. In the test in question, this was impracticable and a current of seven amperes was used.

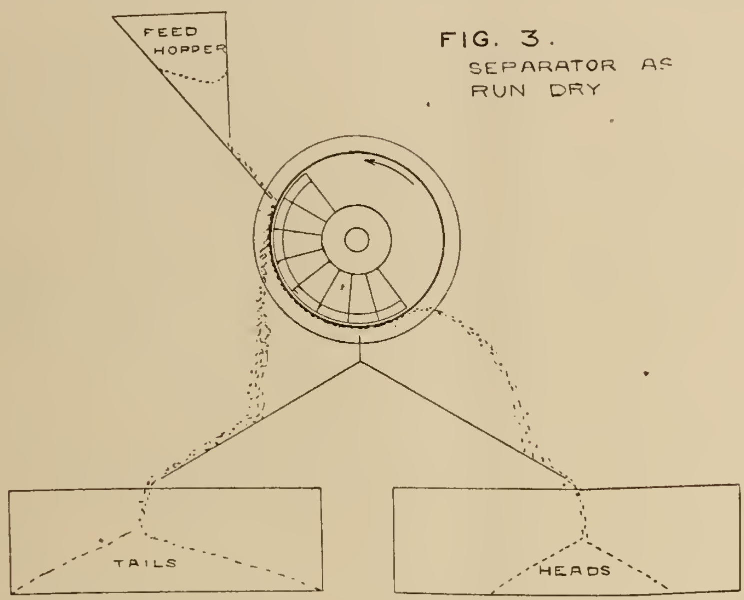


FIG. 3.
SEPARATOR AS RUN DRY

The only dry run that has been completely assayed as on a sample of sand containing about 57% metallic iron and 16.2% TiO_2. It is probable that the major part of the titanium was in the form of ilmenite. Some may have occurred as rutile, and some no doubt was contained in minute grains of ilmenite enclosed in magnetite. Assuming that the titanium occurred as ilmenite (Fe Ti O_3) the 16.2% of TiO_2 had combined with it 16.2 x 56|80 = 11.3% of iron, so the amount of iron capable of being magnetically separated from the titanium would be only 57.0—11.3 = 45.7%. If rutile (TiO_2) was present the percentage of iron free from titanium may have been more. If much titanium was enclosed in magnetite the free iron may have been less.

The result from 52 lbs. of sand was 22 lbs. of heads assaying 70.46% of metallic iron and 1.91% of TiO_2 and 30 lbs. of tails assaying 45.30% of metallic iron and 23.30% of TiO_2. This works out to a recovery in the heads of 65% of the total free iron, the heads carrying less than 1|16 of the titanium. A considerably better recovery than this could have been ob-

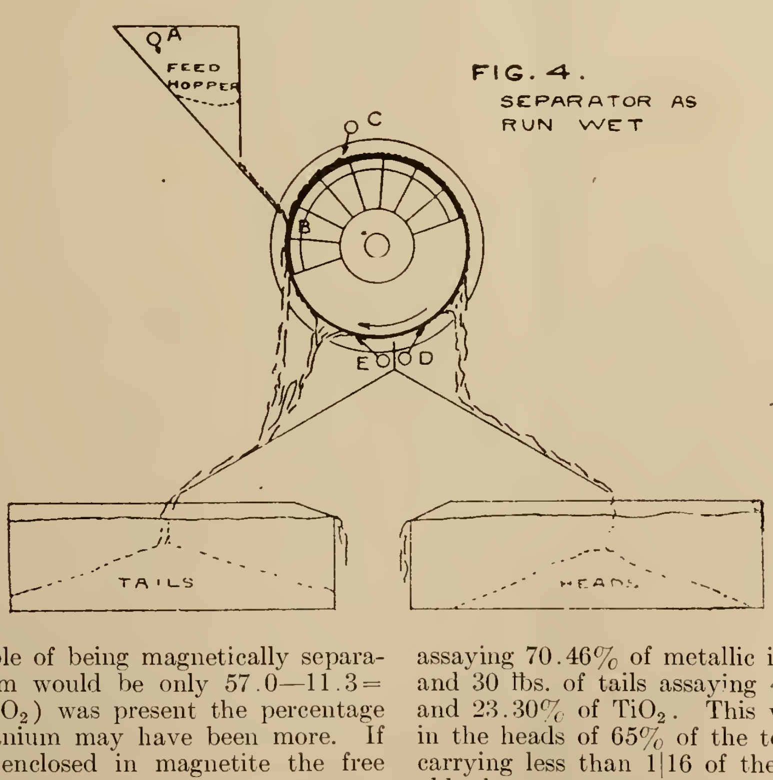


FIG. 4.
SEPARATOR AS RUN WET

tained with a slightly higher amperage and no harm done to the product as iron ore having 2.5% of TiO_2 or under is not abjected to by blast furnace people.

A screen analysis of 43¼ lbs. of tails from a somewhat similar dry run showed:—

(1) Remaining on an 80 mesh sieve ...... 9¾ lbs.
(2) Remaining on a 100 mesh sieve....... 27¾ lbs.
(3) Passing through a 100 mesh sieve .... 5¾ lbs.

Assays of these three sizes showed:

	Fe%	SiO_2%	TiO_2 and Al_2O_3%
Over 80 mesh......	35	15.0	35
80 to 100 mesh......	42	4.5	35
Under 100 mesh	60	1.5	15

The capacity of the machine dry is about 300 lbs. per hour. Its resistance as used is 3 ohms, so the magnets with seven amperes passing required about 150 watts or 1|5 H.P. It takes less than 1|5 H.P. to drive the cylinder, so the total consumption of power is less than one-half H.P. A large machine designed for economy of power could easily do equally good work with one-half or one third of the current and power per unit weight of sand, viz., from 100 to 150 watt hours per 300 lbs. At 10 cents per killowatt hour, this would amount to 7 to 10 cents per ton of sand. The capacity can probably be further increased by running any but very rich sands very fast so as to make a large amount of poor heads, and then cleaning these heads by re-running them.

Run wet, the machine will probably duplicate the work it does dry, but the adjustments need more careful watching and the capacity is lower. Six wet runs on sands from Seven Islands gave heads containing 1.10, 2.36, 2.30 1.48, 1.48, and 1.67% of TiO_2. Preliminary runs on each ore and numerous assays are necessary for the determination of the adjustments required. A wet run for the exhibit of the Quebec Government at the Liege Exhibition, which had to be done without assays or sufficient preliminary work, gave concentrates carrying 7.13% of TiO_2. This sand was practically identical with that used in the six wet runs mentioned above, all of which gave very low titanium in the heads. The assays made after the test was completed, are as follows:—

Heads.	Metallic Iron	64.31%
	TiO_2	7.13%
Tails.	Metallic Iron	44.95%
	TiO_2	20.17%

Heads..............................27 lbs. 12 oz.
Middles (not exhibited)............ 3 lbs. 10 oz.
Tails..............................27 lbs. 11 oz.

61% of the free iron was got into the heads with about 1|5 of the titanium. The sand was the same as that used in the dry run previously described, and is practically identical with that which gave such excellent results when preliminary assays were made.

The capacity of the separator wet is about 100 lbs. per hour. About 0.02 cu. ft. of water per minute is required to reduce the damp sand to a pulp, and about 0.10 cu. feet per minute to wash the tails from the heads. Sometimes water is used for cleaning the heads and tails from the bottom of the cylinder and sometimes not. The water could easily be pumped back and used over and over. The total power used in the present small machine when running wet costs on an average about 50 cents per ton of sand, but on a large machine this could certainly be cut down to one half or one quarter that amount. The separator either wet or dry is usually run at 87 revolutions per minute. The amperages used range from 3 to 11, 5 and 7 being the commonest.

The machine used in the above tests was designed by Dr. J. B. Porter, Professor of Mining Engineering, and built in the shop of the Mining Department of McGill University. The work detailed was all done under his advice and general direction, but great credit is due Mr. R. A. Chambers, a former student, for tests which he carried out on the Seven Islands sand. The author is responsible for the more recent work and thanks are due Mr. J. Obalski, the Mining Engineer of the Province of Quebec, for material. The chemical analyses were nearly all made by Mr. M. L. Hersey, Provincial Analyst, by authority of Mr. Obalski. The main part of the sand was furnished by Mr. William Robertson, of Montreal, but the Seven Islands sand came from Mr. Ganong, of Quebec. The wet and dry tests last made were carried out at the suggestion of Mr. Obalski and samples of all products were included in the Canadian Exhibit at Liege this year.

On the conclusion of the paper the author exhibited a set of samples of the sand sent to Liege, as follows:—

1. Original sand.
2. Heads of dry concentration.
3. Tails dry concentration.
4. Heads of wet concentration.
5. Middles of wet concentration.
6. Tails of wet concentration.

THE GEOLOGICAL SURVEY'S REPORTS ON ASBESTOS AND MICA.

To The Editor:

Sir,—On page 144 of your last issue you make certain comments regarding the publications of this Department and concerning the relations existing between this Department and the Mines Branch, which are so misleading and indeed so far from the facts that I feel sure you will not hesitate to correct the wrong impression these remarks must give the uninformed reader by publishing in your next issue the facts of the case as viewed from the side of the Geological Survey.

The reports that have caused your remarks concerning the above-mentioned relations are those on mica and asbestos by Mr. Cirkel. Anyone not entirely acquainted with the facts and reading your editorial, would certainly receive the impression that Dr. Haanel, inspired by a happy idea, issued these bulletins and that the Geological Survey, not to be outdone, issued a sort of belated rival report.

The actual circumstances of the case are, however, very different. The bulletins on mica and asbestos by Mr. Cirkel do not give, and do not profess to give, any original information concerning these subjects. They are simply (see Mr. Cirkel's letter and introduction) a "collection" of "data and general information," and they purport to be nothing else. More than half the report is based, and partly acknowledged to be based, on information supplied in the reports of our Department—reports and papers by Dr. Ells (see footnote) and a bulletin by the same gentleman (1903-04) of which no mention is made. That part of the reports which is not practically Dr. Ells', deals with (*a*) mining in foreign countries, (*b*) details of mining machinery, and (*c*) the cost of mining. Without the slightest wish to decry Mr. Cirkel's work, I may say that the Geological Survey has generally left these three subjects alone. As to the mining in foreign countries, we find it more convenient to simply give references; as to details of machinery, the mining men, rather naturally, object to their ideas being given away to competitors, and we make a point of publishing no information that could harm legitimate private enterprise; and, finally, as to the cost of production, experience has shown that Government reports dealing, except in a very general way, with these matters are apt to be turned to account by unscrupulous company promoters who are able to put their own version on almost any statement of the kind that may be made.

In this connection, I may say that certain figures in one of these bulletins have already raised considerable trouble, as you, in your position, probably know better than I.

As regards the supposed friction between the Mines Branch and the Survey, you do not seem to be aware that Mr. Cirkel's mica report was revised, edited, and to a considerable extent re-written, by the editor of this Department, who, at Dr. Haanel's request, was permitted to help the Mines Branch in this publication. Dr. Haanel has since signified, in a letter to the Minister, his favourable appreciation of the manner in which this work was carried out.

I remain, Sir,

Yours truly,

ROBERT BELL.

Asbestos, 1886, Geological Survey Report.
1887-88, Geological Survey Report.
1888-89 Mineral Resources of Quebec.
1890-91, Papers in Mining Review and Ottawa Naturalist.
Mica, 1894 Bull. Geol. Soc., U.S.
1899 Vo. 12 Ann. Rep.

RECENT MINERAL DISCOVERIES ON WINDY ARM

A timely and interesting report has just been issued by Mr. R. G. McConnell, B.A., of the Geological Survey of Canada, on the subject of the mineral discoveries which have recently created so much attention on Windy Arm of Tagish Lake, in the Yukon. The principle ore deposits, the report states, occur on the West side of Windy Arm, a southerly branch of Lake Tagish. Windy Arm joins Tagish Lake near its head, and extends south for a distance of 12 miles, its course being nearly parallel to that of Bennett Lake. Two sheets of water enclose an area of mountainous country about 8 miles, and in this region the most recent discoveries have been made. Communication to the new mining district is afforded by the White Pass & Yukon Railway, and it is stated that a railway can easily be built from the Cariboo crossing, along the shores of Lake Nares, Tagish Lake and Windy Arm, to Conrad City. There is also a second feasible route from Log Cabin station.

The report states that: "The mineralized area on Windy Arm is situated a few miles north of the great granite area of the Coast Range. The rocks outcropping along the lower part of Windy Armconsist of a wide band of crystalline limestone, followed, going south, by hard slates and shales passing in places into feldspathic quartzites and associated .with dark and gray cherts and red jaspers. This clastic series is cut off and replaced about five miles above the mouth of the Arm by an eruptive rock of a porphyritic character, exposures of which outcrop along the shores of the Arm for a distance of about five miles. The porphyrite is followed, going southward, by strongly cleaved dark argillites and fine-grained tufaceous sandstones alternating with bands of conglomerates and limestone. These rocks are less altered than the slates and associated rocks north of the porphyrite area but no data sufficient to determine the age were obtained. They are cut off a few miles south of Windy Arm by the great granite mass of the Coast Range.

The porphyritic rock separating the two series of clastic rocks constitutes the principal metalliferous formation of the district. It crosses from Windy Arm to Bennett lake in a band about four miles in width and also extends some distance east of Windy Arm. It has not been studied in detail, but is evidently somewhat complex in character.

A granite area about three miles in width occurs on Lake Bennett north of the porphyrites and associated rocks. The granite is separated from the latter on the lake shore by a narrow band of slates and limestones, but, further inland, comes in contact with them. It is a medium grained, gray rock similar to the Coast Range granites and probably belonging to the same period of igneous activity.

The largest and most persistent veins so far discovered occur in the porphyrite area. They are not, however, confined to this formation, a few occurring in the granite and some, also, in the slates. The veins occupy typical clean-cut fissures with regular walls often slickensided and grooved. They are comparatively narrow but as a rule exhibit remarkable persistency in strike. The Uranus vein, with a width of from one to four feet, has been traced by small openings and surface showings for a distance of about 1,500 feet and may extend much farther, while the Montana vein, with a maximum width of five feet in the portion explored, has apparently been cut at a distance of 1,600 feet from the main workings and may also of course be very much longer. The Venus No. 2 lead has a width of nine feet at two openings about 400 feet apart, and must extend for long distances in both directions. Numerous other veins such as the M. and M., the Joe Petty and Venus No. 1 are traceable by surface outcrops for several hundred feet. Portions of all these veins are concealed by slide rocks and their full length was not ascertained.

The dip and strike of the veins are exceedingly irregular. The Montana vein strikes N. 43 W., while the direction of Venus No. 2 is about N. 42 E. The M. and M. strikes nearly north and south. The dips are nearly all to the south and west and vary in steepness from 12° in the Montana to 50° in Venus No. 1.

The gangue in all the veins is mainly quartz. Single and multiple lines of interlocking quartz crystals is a constant feature. In a few instances, portions of the veint filling consist of alternating layers of quartz and country rock. The latter, in such cases, is always heavily mineralized, usually with iron, and weathers to a rusty colour.

The list of metallic minerals contained in the veins as identified in the field, and in the laboratory of the Survey from specimens brought back by the writer includes the following:—Native Silver, Argentite, Stephanite, Freibergite, Pyrargyrites Galena, Tetrahedrite, Chalcopyrite, Native Copper, Malachite, Azurite, Iron Pyrite, Arsenopyrite, Pyrrhotite and Sphalerite.

The general outlook for the camp is considered exceedingly promising, and its opening up marks an important event in the mining history of the country.

The mining conditions are not unfavourable. Most of the veins are situated at distances of from half a mile to four miles from the lake and at elevations of from twelve hundred feet to three thousand six hundred feet above it. Aerial tramways can therefore easily be constructed for the carriage of the ores to the lake shore for concentration and can also be used to take supplies to the mines. Miners' wages during the past season amounted to $3.50 per day for eight hours work, and ordinary labourers obtained the same amount for ten hours work. The cost of supplies, considering the short distance to the seaboard, and the almost continuous rail connection, ought to be moderate. The climate, while severe during a portion of the year, will have little effect on mining operations.

THE MINING CONVENTION AT TORONTO.

The Mining Convention to consider what changes should be made in the Ontario Mining Laws met at Toronto on the 12th of December and continued in session for four days. The result of the deliberations was the adoption of the appended resolutions, though some of them were not adopted by any means unanimously, and several of them were adopted after many delegates had left the meeting. Mr. W. D. Macpherson, barrister, of Toronto, was elected Chairman of the convention, and Fred. A. Fenton, of the same city, secretary.

(1). That it is the opinion of this convention that there should be only one mining law for the whole Province.

(2). That all lands belonging to the Crown, whether surveyed or unsurveyed, and whether valuable for timber or not, should at all times be open for exploration and sale, and that no lands should at any time or under any circumstances be withdrawn from exploration or sale by order in Council or otherwise, and that when discovery of mineral be made on a timber limit valuable for pine, of sufficient value to warrant mining operations, a location title be issued to the discoverer, so that he may have a negotiable interest in his discovery, and that after such location the owner of the timber berth be given a limited time, not to exceed three years, in which to remove the pine, after which date the ownership to the mineral discovery shall be absolute, subject only to the working conditions under the mining act.

(3). That the district known as New Ontario, and any other section of the Province of Ontario which is or may become valuable for minerals, should be formed into recording districts, with a recording office in each district, and that all applications for mineral shall be made to the recording office of the district in which the mineral is found. That each recording office shall have on file all applications and all records for its division, and also maps showing all locations, which shall be open for inspection by the public.

(4). That it would be injudicious to provide for payment of any royalty or for a special tax applicable to the mining industry.

(5). That any licensee may stake out a location without first making a discovery of mineral thereon, under stringent working conditions to be decided by this meeting.

(6). All locations shall be forty acres, except in the case of fractional locations. In unsurveyed territory the location should consist of a fractional part of a lot as mentioned in subsection 2 of section 18 of the Regulations of Mining Divisions governing the Temiskaming Mining Division.

(7). That the licensee may stake out a mining location on behalf of himself, or any other licensee, square in shape, and the bearings of the outlines thereof shall be due north and due south, and due east and due west astronomically. Such location shall be 20 chains in length and 20 chains in width, containing 40 acres. And the licensee shall plant at each of the four corners of such location a post of wood in the order following, viz.: No. 1, at the north east corner; No. 2, at the south east corner; No. 3, at the southwest corner; No. 4, at the northwest corner; the number in each case to be upon the side of the post turned towards the post which follows in the order in which they are named; and if one or more corners of a location fall in any situation where the nature or shape of the ground renders the planting of a post or posts impracticable, such corner or corners may be indicated by placing at the nearest suitable point a witness post, which in that case shall contain the same marks as those prescribed herein for corner posts, together with the letters W.P., and indication of the bearing and distance of the site of the true corner from such witness post. And the licensee shall also plant a post of wood 6 feet southwest of the northeast corner post, to be called the recording post. And such recording post shall have four faces at least six inches wide, and shall be at least four feet above ground. Where there are standing trees upon a mining location so staked out the licensee shall blaze the trees and cut the underbrush along the boundary lines of the location about two feet wide. Where there are no standing trees the licensee shall mark the boundary lines of the location by planting pickets or stakes thereon, or by erecting thereon monuments of earth or rock, not less than two feet diameter at the base and at least two feet high, so that the lines can be distinctly seen. The licensee, on behalf of himself or on behalf of any other licensee for whom he may have staked the location, shall nail upon the recording post of such location the staking record, in which he shall insert the date of staking.

(8). That all locations shall be recorded within 15 days after staking, if within 10 miles from recording office, but that one day additional be allowed for each additional 5 miles.

(9). That during the period allowed between the date of staking and the date on which the said claim is required to be recorded, in accordance with the preceding resolution, the licensee first staking the same shall be entitled to full possession of the said claim, and to otherwise have his rights fully preserved in respect thereof.

(10). That a licensee may be required to expend at least $100 in actual mining work during 90 days immediately succeeding his application, excluding from such computation the months of January, February and March, and also a similar amount during the three succeeding years, or prior thereto, but such expenditure shall be computed at the rate of $3 per day for each days work performed by a grown man, and that an affidavit proving such expenditure be filed with the recorder within 30 days after the time allowed for the performance of each such expenditure.

(11). For every adjoining five locations or less held by one or more licensees and which are principally valuable for base metals, all such development operations may be carried on upon one or more of the locations.

(12). That, whereas, there are numerous deposits of good iron ores in Ontario which at present are not being worked because our furnaces to a great extent use United States ores, this convention recommends that the Ontario Government grant to the ore producer a bounty for the production of each ton of iron ore raised in the province.

(13). That the Dominion Government be recommended to admit coal free of duty, if used to make coke to be used for the smelting or treatment of iron ores.

(14). That the price of mineral lands should be uniform all over the province, at the rate of $2.50 per acre in surveyed territory and $2 per acre in unsurveyed territory.

(15). That the Department of Lands and Mines should be divided into a Department of Crown Lands and a Department of Mines, with a minister at the head of each.

(16). That all mining partnerships shall be recorded at the recording office in which the mining claim is registered, and a simple method for the registration, dissolution and enforcement of other rights of the partnership shall be provided.

(17). That all affidavits required under the Mines Act may be sworn to before any Justice of the Peace, Notary Public, Commissioners for taking affidavits in the High Court, or any agent appointed under the Mines Act or any Crown Lands agent.

(18.) That in the opinion of this meeting the province of Ontario should erect a smelter and refinery capable of smelting, treating and refining the silver-cobalt ores, and should make provision for the treating and refining of the copper and nickel ores of the province.

(19). That although in the opinion of this convention of Ontario miningmen, it is desirable that assistance be given by the Dominion Government in the way of granting of bounties on pig iron smelted in the Dominion, we wish to strongly protest against the present system of paying bounties on pig iron smelted from foreign ores, and ask that the same be discontinued when the present law expires in June, 1907, but that the bounty on pig iron made from domestic ore be placed at $3 per ton for the next five years.

(20). It is recommended that any miner's license issued shall entitle the holder thereof to stake and hold mineral locations upon Crown lands in all parts of this province. That all such licensees shall assume the responsibility of assisting in extinguishing, and at all times endeavouring to prevent forest fires on Crown lands, subject to a penalty of not less than $20 in case of refusal to so act. That such licenses shall run for one year from the date thereof, and shall not be transferable. That no person, or joint stock company, shall be recognised as having any right or interest in or to any mineral location unless he or it shall have an unexpired miner's license.

(21). That the northerly 6,400 acres of the Gillies timber limit (which comprises 64,000 acres), be conveyed and granted by the Province to a company to be incorporated with $900,000 capital, in $1 shares, 300,000 of such shares to be divided pro rata free of charge, but fully paid up, among the licensees of the Temiskaming mining division, licensed prior to December 9, 1905, 300,000 fully paid up shares to be given free to the Province of Ontario, and 300,000 shares to be sold at par to citizens of Ontario, who apply for the same, and deposit ten per centum of such price at the time of making such application, in order to secure money to purchase the pine thereon and carry on development operations, and to make suitable reward to parties who know of the existence of minerals on the said lands, such treasury shares to be allotted equally per capita in the event of over-subscription. That each section of shareholders be entitled to the exclusive right of electing three directors to constitute a board of mine directors for the company.

Some amendments were offered to this resolution but after discussion it was decided that both the resolution and the amendments should be laid on the table. The general opinion expressed was that the problem is one of the most difficult the Government has to deal with, but that some satisfactory solution would be arrived at.

(22). That the Government be recommended to proceed at once with the re-survey of all townships where marks are obliterated, and also survey all valuable mineral lands in unsurveyed territory, and that the corners of all sections be marked with iron posts.

(23). That the Government should procure expert evidence as to the advisability of fully testing the Thunder Bay silver district by sinking through the silicious schists of the Animikie formation, into the lower Huronian strata, for the purpose of demonstrating the value of veins in the lower formation.

(24). That any applicant for a mining location shall at the expiration of the time for his development work file with the recorder at least two affidavits of practical miners that he has complied with the regulations, otherwise the claim shall be considered abandoned.

(25). That no licensee shall stake out or apply for more than two mining locations principally valuable for precious metals, or more than four locations principally valuable for base metals, within a radius of six miles thereof during any one calendar year, either in his own name, or in the name of any other licensee.

(26). That in the opinion of this convention it would be advisable for the Ontario Legislature to offer prizes for the demonstration of satisfactory methods for the treatment of refractory ores for which no satisfactory method is now in use or known in this country.

(27). That the section of the Municipal Act giving township councils ownership of minerals on concession and side lines be abolished, and the mineral thereon should be dealt for direct with the Crown Lands Department, the same title to be issued as is issued for the adjoining land.

(28). That contests arising regarding the location and ownership of mining claims should be decided by a mining commission sitting judicially at various mining centres, whose decisions should be subject to appeal to the Court of Appeal only.

(29). That this convention ask the Government to consider the question of lands from which the prospector is debarred on account of the impossibility of perfecting title, and of larger mineral areas held idle, and devise some remedy if possible.

BRITISH COLUMBIA MINING IN 1905.

The Nelson *Daily News*, in a special issue dated January 1st, publishes a most exhaustive review (largely compiled, we understand, by Mr. E. Jacobs, editor of the British Columbia *Mining Record*) of mining in British Columbia during the past year. In considering the mineral production made, it is estimated that an increase in yield to the value of nearly $2,500,000.00 will be shown, and in fact the year will be a record one in respect to production. The following comparative table is given of the yield of 1904, and estimated returns of 1905.

The next following table shows the respective totals of value of minerals produced in 1904 and 1905:—

	1904	1905	Increase.	Decrease.
Gold, placer	$1,115,300	$1,110,000	....	$5,300
Gold, lode	4,589,608	4,640,000	$50,392	
Total gold	$5,704,908	$5,750,000		
Silver	1,719,516	2,045,000	325,484	
Copper	4,578,037	5,430,000	851,963	
Lead	1,421,874	2,368,000	946,126	
Zinc		320,000	320,000	
Total metalliferous	$13,424,335	$15,913,000		
Coal	3,760,884	3,090,000		$670,884
Coke	1,192,140	1,210,000	17,860	
Building materials, etc.	600,000	750,000	150,000	
Total non-metalliferous	$5,553,024	$5,050,000		$676,184
Total increase			$2,661,825	
Less decrease			676,184	
Net increase			$1,985,641	

Being about 10.4 per cent.

SUMMARY.

	1904	1905
Metalliferous	$13,424,336	$15,913,000
Non-Metalliferous	5,553,024	5,050,000
Total production	$18,977,359	$20,963,000

In calculating the values of the several minerals to obtain the totals shown in the foregoing table, placer gold has been taken as worth $20 per oz., lode gold at $20.67 per oz., silver at 60 cents per oz. less 5 per cent; copper at 15 cents per lb., lead at 4.6 cents per lb. less 10 per cent.; zinc has been averaged at $24 per ton, coal valued at $3 and coke at $5 per ton of 2,240 lbs.

The quantities of minerals produced were as under:—

	1904	1905	Increase.	Decrease.
Gold, placer—Ozs.	55,765	55,500		265
Gold, lode—Ozs	222,042	224,490	2,448	
Total gold—Ozs.	277,807	279,990	2,183	
Silver—Ozs.	3,222 481	3,587,719	365,238	
Copper—Lbs.	35,710,128	36 200,000	480,872	
Lead—Lbs	36,646,244	57,200,000	20,553,756	
Zinc—Tons		13,330	13,330	
Coal—Tons of 2,240 lbs.	1,253,628	1,030,000		223,628
Coke—Tons of 2,240 lbs.	238,426	242,000	3,574	

The features of the year have been, briefly, the great increase in the copper and gold output of the Boundary District, which very nearly carries a million tons; the increase in silver-lead production, and the development of the zinc mining industry.

A special article is contributed to this issue by Mr. G. O. Buchanan, on the "Lead Situation," in which it is stated that the production for the calendar year (December being estimated) is 28,636 tons, divided as follows:—

	Lbs. Lead.
Hall Mining & Smelting Co (Nelson)	17,785,862
Canadian Smelting Works (Trail)	12,785,901
Elsewhere in B. C.	11,206,169
Exported in ore to Europe	15,525,835
	57,272,767
Equal	28,636 tons
Output, 1904	20,000 tons
Increase	8,636 tons

Mr. Buchanan states that except for the blank in shipments from the St. Eugene caused by damage to their works by fire (the months of October and November having been practically lost), the output for 1905 would have gone close to that of the banner year, 1900, which was 31,679 tons.

For the fiscal year ending June 30, 1905, the returns to the department of trade and commerce for bounty purposes show as follows:—

	Lbs. Lead.
Delivered to B. C. Smelters	33,704,932
Exported to Europe	21,972,999
Total	55,676,931
Equal to 27,838 tons.	
Bounty earned, home smelted lead	$240,058.71
Bounty earned, exported lead	97,157.30
Total	$337,216.01

For the year ending June 30, 1904, the figures were:—

Lead production	13,397 tons.
Bounty earned	$195,283.92

The term for which a bounty was payable upon lead in ore exported to Europe ended on June 30, 1905, and a proposition for the extension of the term was not favorably considered by the government.

On November 29, 1904, lead was quoted in London at £12 12s. 6d., and the rate of bounty payable was reduced, the rate of diminution being 1.3579 cents per 100 pounds of lead for each advance of one shilling and three pence above £12 10s., the whole bounty being wiped out by 57 of such advances.

The price went to £13 3s. 9d. on January 6, fell to £11 17s. 6d. on March 3, rose to £12 11s. 3d. on April 4, and from that time has steadily climbed until £16 was reached on November 29, and the extinction of bounty payments, for the time being, was accomplished.

On December 12, £17 8s. 9d. was reached, but at the moment of writing this, the quotation stands at £17 2s. 6d.

The extremes of variation for the last five years have been:

	£	s.	d.
1900—September 15	£18	0	0
1902—January 14	10	5	0
1903—March 12	13	15	0
August 16	10	18	9
1905—December 12	17	8	9

That lead will remain permanently above £16 is not to be expected, but it is probable that we have seen the last of £12 lead. The predominant influence of the American Smelting & Refining Company, not so much in favor of an extremely high price, as of a steady price, is beginning to be internationally felt, and there is beyond that, universal testimony to the fact that the legitimate demand for lead has overtaken the supply, that the demand is growing and bound to grow, and the sources of fresh supplies are not in sight.

Of our home-smelted product the electrolytic refinery at Trail is now treating 50 tons per day, or at the rate of 18,000 tons per annum. At the present moment the refinery is busy with orders for Canadian consumption, and it is probable that we can count the Canadian market as good for, from this time onwards, 18,000 tons per annum.

The product of the Trail refinery in both silver and lead exceeds in purity any hitherto produced upon a commercial scale, and both metals command a premium in competition with the product of other refineries.

The year has introduced an era in the provision of lead smelting facilities. In the early spring the Sullivan company's new smelter went into blast at Marysville in East Kootenay.

This smelter has two stacks of a capacity of 100 tons per day (only one of which has yet been in use) each, and the appointments and machinery embody the most modern features.

With commendable enterprise this company installed as a part of their plant a Huntington-Heberlien outfit of ovens and pots for ore roasting.

While nothing as to results has been given out by the company, the fact is patent that the smelter has run almost continuously with no ore supply except that afforded by their own mine, a grade of ore with some reputation as difficult, from a smelting standpoint.

That the object lesson has not been lost is evidenced by the fact that at both the Hall Mines and Trail smelters, similar roasting plants are under erection.

The Hendryx smelter at Pilot Bay after nine years of idleness is undergoing renovation at the hands of the Canada Metal Company, and it is announced that the lead stack will soon be in commission.

This latter company, of which C. Fernau, Esq., M.I.M.E., is the manager, and which has its head office at Nelson, and which has almost completed at Frank, Alta., a massive establishment for the treatment of zinc ores, proposes to have also a lead stack at an early date at Frank. This multiplication of smelters and introduction of metallurgical economies, should certainly foreshadow better treatment rates for the producer at an early date.

The subject of zinc will no doubt be fully dealt with elsewhere in this review, but it may be mentioned here that some profitable disposition of the increasing quantities of zinc ore developed in connection with lead mining in the Slocan and

Ainsworth camps, had become the most serious problem confronting the mine owner.

The problem has been attacked from all sides, by local enterprise in the installation of separating plants, by foreign capital in the erection of the magnificent works at Frank, and by commission of enquiry under the direction of the most eminent living specialists, employed by the Dominion Government.

As items of special interest we have room for but few.

The long tunnel on the Rambler-Cariboo is scheduled to reach the ore body (at least the place where it ought to be) on May 1. Ore from stringers recently cut has shown values similar to those for which the shipments from the upper workings were framed.

The Monitor and Ajax fraction mine after a prolonged suspension of production has again entered the list of shippers, and its mammoth and completely equipped concentrating mill at Rosebery is in successful operation.

In the Ferguson camp the Silver Cup mine has large quantities of ore in sight, and is ready to ship heavily.

The La Plata Mines on Kokanee creek (we once spoke familiarly of them as the Molly Gibson) have concentrating works installed, and a bright future outlined.

A question of "apex rights" growing out of the 1892 Mineral Act, of which the contestants have been J. M. Harris of the Reco mine, and the Byron N. White Co., has resulted in much prosperity to the legal, and mining expert fraternities, and to a decision which for the present upholds the apex rights of the Byron N. White Co.

The Ivanhoe, after holding for some years a place near the head of the procession as a shipper, has paused to take breath, and recover its ore bodies.

The old time Blue Bell, now in the hands of the Canada Metal Co., is being put in shape for heavy production, and will be an important factor in feeding the works at Pilot Bay and Frank.

In the Slocan camp the "leasing system" has come to stay, having proven profitable to both parties concerned, and the Payne, Whitewater, Whitewater Deep, Wakefield, Lone Bachelor, Hewitt, Emily Edith and a host of others are under operation on that basis.

Extensive works for the corrosion of lead were established during the year in Montreal by the Carter White Lead Company. The contract for their supply of pig lead for a term of years is held by the refinery at Trail. Their methods of corrosion is new and improved, and this coupled with the perfect freedom from adulteration of the lead from Trail has enabled them to put upon the market a grade of paint lead never equalled. The works are rushed with orders, and their requirements of raw material accordingly increased.

Largely as the result of the persistent agitation begun and for the last seven years carried on in this district, the finance minister carried through Parliament at its last session a bill increasing the duty upon corroded lead from 5 to 30 per cent.

At a sitting of the Tariff Commission held in Nelson in September, interested parties were heard upon the subject of an increase in the duty upon other lead products (including pig).

The Tariff Commission is expected to report at the coming session.

COAL NOTES.

ALBERTA.

It is reported that the Western Canadian Collieries Company is, since the new washer has been installed at Lille, now producing a very fine quality of coke. This is the first coalwasher to be installed in Alberta. It is of the Luhrigtype, with a capacity of over 700 tons a day.

The Canadian-American Coal & Coke Company recently commenced working on the principle seam of the mine, which has been abandoned since April last, on account of fire. It is proposed to increase the working force of the mine by the employment of 100 more miners, as it has proven difficult to maintain a supply sufficient to meet the demands of the C.P.R.

BRITISH COLUMBIA.

The *Official Gazette*, in a recent issue publishes the following list constituting a board of examiners under the Coal Mines Regulation Act for the current year. Cumberland collieries:—Appointed by the owners, Charles Matthews; alternates, David Walker, John Combs. Appointed by the Lieutenant-Governor in Council, John Kesley. Elected by the miners, James Reid; alternates, Thomas Ripley, Joseph Horbury.

For the Extension colliery: Appointed by the owners, James Sharp; alternates, Alex. Bryden, Alex. Shaw. Appointed by the Lieutenant-Governor in Council, W. G. Simpson. Elected by the miners, Thomas Doherty; alternates, Wm. Anderson, Benj. Berto.

For the Nanaimo colliery:—Appointed by the owners. Thomas Mills; alternates, George Wilkinson, Charles Graham, Appointed by the Lieutenant-Governor in Council, Thomas Budge. Elected by the miners, George Moore; alternates, John R. McKenzie, George Johnson.

For the Michel colliery:—Appointed by the owners, A. R. Wilson; alternates, Wm. Powell, Thos. Corkill. Appointed by the Lieutenant-Governor in Council, Evan Evans. Elected by the miners, James Wylie; alternates, Sidney Bert, Joseph Thomas.

For the Coal Creek colliery:—Appointed by the owners, David Martin; alternates, Andrew Colville, John Hunt. Appointed by the Lieutenant-Governor in Council, John McCliment. Elected by the miners, J. H. Suggett; alternates, Wm. Moore, Chas. Webber.

Coal mining generally on Vancouver Island is now again in a prosperous condition. At Cumberland No. 7 mine has been well opened up, and is producing a fair tonnage of anthracite, discovered some three or four years ago. During recent developments a serious fault was encountered, but this was passed through in due course, and excellent coal again reached. During the year the buildings destroyed at No. 4 have been re-erected, and a series of large shops have also been built at Union Bay.

It is reported that the Carbonado colliery will probably be closed down temporarily before the end of January. The company find it is much more economical to operate the Coal Creek and Michel collieries at the full limit, in order to supply the market requirements. It is estimated that the Carbonado colliery does not pay to operate when the output is less than 600 tons daily.

NOVA SCOTIA.

Two promising seams of coal, one of 5 feet wide, were recently discovered at the Smith mine, at Maccan. The recently organized Eastern Coal Company, operating this property, contemplate installing screening and other machinery immediately.

The Nova Scotia Steel & Coal Co. are making preparations for the opening of a new colliery at Sydney mines to be known as "Sydney No. 4." This colliery will be opened about a mile north of the present Sydney No. 3. The new colliery will be one of the largest operated by the Nova Scotia Co., and it is the intention to operate it by electricity entirely. In every other respect, also, the very best and latest methods will be adopted.

The Inverness Railway & Coal Company is sinking test pits preparatory to putting down a new shaft about half a mile from the present bankhead.

THE GEOLOGICAL SOCIETY OF AMERICA.

The eighteenth winter meeting of the above Society was held in Ottawa on December 27th, 28th and 29th. The following papers were read:—

A New Species of Soda-alumina Pyroxene. By S. Weidman, Madison, Wis.

A Dike of Mica-Peridotite from Fayette Co., Southwestern Penn. By J. F. Kemp, New York City.

Origin of Leached Phosphates. By C. H. Hitchcock, Hanover, N.H.

Bibliography of the Geology, Mineralogy and Paleontology of Brazil. (Read by title). By John C. Branner, Stanford University, Cal.

The Peninsula of Calabria in its Tectona-Geographic and Geodynamic aspects. By William H. Hobbs, Madison, Wis.

Torrential Deposits, and the Origin of Sandstones and Conglomerates. By William H. Hobbs, Madison, Wis.

Volcanic Craters of the Southwest. By Charles R. Keyes, Socorro, N. Mex.

Hawaiian Notes. By C. H. Hitchcock, Hanover, N.H.

Western Sierra Madre of the State of Chihuahua, Mexico. By Edmund Otis Hovey, New York City.

The Oldest Pre-Cambrian Rocks. (15 minutes). By C. K. Leith, Madison, Wis.

Algonkian Formations of Northwestern Montana. By Charles D. Walcott, Washington, D.C.

Paleography of St. Peter Time. (Read by title). By Charles P. Berkey, New York City.

Notes on Arctic Geology. (Lantern Views; 20 minutes). By Albert P. Low, Ottawa, Can.

The Lefroy, a Parasitic, Glacier. (Lantern Views; 20 minutes). By William H. Sherzer, Ypsilanti, Mich.

Origin of the Massive Block Moraines in the Canadian Rockies and Selkirks. (Lantern Views; 20 minutes). By William H. Sherzer, Ypsilanti, Mich.

THE WORLD'S PRODUCTION OF COAL.

The British Board of Trade statement for 1904, just received, gives the total coal production of the world (exclusive of brome lignites) as 790,000,000 tons of 2,240 lbs. Of this large amount the United States alone produces rather more than one-third, and Canada a little less than one-onehundredth. The following table shows the yield of each of the five largest coal producing countries for three years:—

Years.	United Kingdom.	Germany.	France.	Belgium.	U. States.
	Tons.*	Tons.†	Tons.†	Tons.†	Tons.*
1902 . . .	227,095,000	107,474,000	29,365,000	23,877,000	269,277,000
1903 . . .	230,334,000	116,638,000	34,218,000	23,797,000	319,068,000
1904 . . .	232,428,000	120,816,000‡	33,838,000‡	23,507,000‡	314,563,000

* Tons of 2,240 lbs. † Metric tons of 2,204 lbs.
‡ Provisional figures.

In the next table we give the production of the principal British colonies:—

British India	Australian Commonwealth.	New Zealand.	Canada.	Transvaal.	Cape of Good Hope.	Natal.
Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
7,438,000	7,112,000	1,420,000	6,825,000	2,012,000	185,000	714,000

The consumption of coal per head of population in these colonies is shown in the next table, in which it will be noted that Canada leads, due, doubtless, to our cold climate.—

Australian Commonwealth.	New Zealand.	Canada.	Cape of Good Hope.	Natal.	Transvaal.
Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1.30	1.71	1.81	0.29	0.40	1.23

DOMINION STEEL COMPANY IN 1905.

The record made by the Dominion Steel Company the past year has been very satisfactory. The total production of pig iron was 162,000 tons, of the open hearth steel furnaces 173,500 tons, and of the rolling mills 47,000 tons. Of eighty pound steel rails, 44,000 tons have been already turned out. The production of coke amounted to 242,150 tons.

Over half a million tons of coal was consumed by the company in its different operations, as well as 380,184 tons of iron ore, 267,237 tons of limestone and dolomite, and 13,711 tons of gravel and sand.

During the height of the season 4,000 men were employed by the company, and the pay roll exceeded $2,000,000. Perhaps the most important announcement that the company has to make is that it has advanced from being a mere purveyor of raw materials to the position of a producer of finished materials.

From the United States, Spain and other foreign countries, the following minor supplies were drawn: 19,403 tons special iron ore, 1,257 tons manganese ore, 2,531 tons pyrites ore, 1,850 tons spiegel, ferro manganese, etc.; 3,450 tons fluorospar, 461 tons calcined magnesite. During the greater part of the year two blast furnaces were in operation, but about the middle of November a third was blown in. The fourth will be kept in readiness to take the place of any of the other three that may require to go off for repairs.

At the beginning of 1905 six open hearth furnaces were in operation. This number was gradually increased until the whole ten were in use in September and the remaining months of the year.

As a result of tests, Dominion wire rods have practically captured the Canadian market, and importations have been reduced to a minimum.

PLATINUM IN PLACE IN BRITISH COLUMBIA.

It is reported that ore, carrying 4 oz. of platinum to the ton, has been discovered on a claim on Bear Creek, Nicola district, B.C., these returns having been obtained from analyses made by Messrs. Baker & Sons, platinum refiners of NewYork. In this connection, a Mr. C. F. Law, of Vancouver, writes to the *Engineering and Mining Journal* as follows:—

"It may interest your readers to know that a discovery of platinum has been made in place, on Bear Creek, a tributary of the Tulameen river, in British Columbia. Baker & Co. report that a sample of ore, sent to them for assay, contains approximately 4 oz. platinum per ton. This sample was taken by myself from an ore-shoot 4 ft. wide in a fissure vein. This was sampled by Thomas Kiddie, manager of the Crofton smelter, in British Columbia, and was found to contain: copper (wet), 1.38%; silver, 20.83 oz.; gold, 2.64 oz. per ton from wall to wall without selection. The presence of platinum was not suspected, although the vein occurs in a known platinum district; and the same belt of rock in which the vein occurs has yielded platinum where eroded by the Tulameen river. The gangue is quartz, the ore itself being pyrite, pyrrhotite and chalcopyrite, in schist close to the granite."

"I was led to have this ore assayed for platinum by an article which appeared in your Journal some time ago, referring to platinum values having been found in the nickel-copper ores of Sudbury and the copper ores of the Rambler mine, Wyoming."

ONTARIO MINING INTELLIGENCE.

(From Our Own Correspondent.)

A case affecting the ownership of the Josephine iron mine, near Michipicoten Harbour, was recently argued before the Hon. F. Cochrane, Minister of Lands and Mines. Decision was reserved. Alois Goetz, a resident of Michigan, petitions to be declared, by right of discovery, the owner of the mine. The ownership of the property is also claimed by the Lake Superior Corporation as part of the land grant to the Algoma Central Railway. The latter has been for some years in possession of the mine on which extensive development work has been carried on.

The Savage Cobalt Company, one of the new companies recently organized to operate at Cobalt, has a 42 acre property at the south end of Peterson Lake. A shaft has been sunk 50 feet, where a rich vein has been struck, but some trouble having arisen from water a steam pumping plant has been installed, which will be in operation the first of the year and work continued throughout the winter. The company has also erected necessary buildings on the property. A sample of 60 lbs. of ore sent to the School of Practical Science, Toronto, yielded a handsome return and ten veins of silver have been found on the territory so far prospected.

The Cobalt Development Co. has acquired and paid for a silver-cobalt property in the township of Coleman and one in Bucke, and is negotiating for another in Coleman. It is proposed to work these properties directly the snow is off the ground in the spring. Stock is issued in shares of $100 and the proceeds will be used in development. The directors are:—Messrs. Ewan Mackenzie, President, Toronto; William Dobie, General Manager and Treasurer, E. W. Gillett Co., Toronto; — Lamb, Cordova Mines, Ont.; E. I. Sifton, London, Ont.; Perry L. Hobbs, Cleveland, Ohio; Thomas E. Aikenhead, Hardware Co., Toronto; P. MacIntosh, MacIntosh Food Co., Toronto; Henry D. McNaughton, Rochester, N.Y.; George Stevenson, Toronto. G. D. Hardy is performing the duties of Secretary and Manager.

Decision has been given in the case of Gaizer *vs.* Thompson, referred to in the December number of the Mining Review, as affecting Cobalt properties. A lease had been issued to Thompson, who held the property in trust for the Hudson's Bay and Temiskaming Mining Co. The Attorney General, to whom the case was referred, has decided that an action should be brought in the High Court of Justice to set aside the lease, which means that it is a case which should be investigated, and it will now go before the Courts on its merits. The ground on which it is sought to set aside the lease is that there was no valuable discovery of mineral. The case was argued by Mr. J. M. Clark, K.C. for Gaizer and Mr. E. F. B. Johnston, K.C. for Thompson.

With reference to the possibility of finding diamonds in New Ontario, referred to recently, Dr. Bell, acting director of the Canadian Geological Survey, states that he does not believe that they will ever be discovered in Canada.

A syndicate in which Toronto people are interested, is understood to have secured the right to use a German process for the treatment of Cobalt ores. The company has a capital of a million or over, and will erect reduction works in the Cobalt district at an early date. The difficulty with the Cobalt ores has been that there is no process known by which they could be refined so as to save all their constituents, and the New Jersey Co., which has purchased a large proportion of the output, has much of it on their hands untreated. The German process is a secret one, but should it be a success, much low grade ore, now left on the dump, can be turned to account, while full value will be realized for the ores of high grades. In addition, the smelting will be done in Canada and so add another industry.

The new iron field in Algoma, west of the Vermillion River, some 60 miles from navigable water at Killarney, is stated to be from 30 to 40 miles long and second in importance only to the Mesaba range. The ore is partly Bessemer and contains only from 6 to 7 per cent. of phosphorus and 61 qer cent. of iron. Part of it is in the unsurveyed territory and some is covered with valuable pine timber, which may give rise to difficulty similar to that over the Gillies limits at Cobalt. With a railway to deep water the rate of freight to Cleveland and other lake ports would be about $1 a ton, which is considerably less than from Duluth.

The McLeod claim at Cobalt has been purchased by B. B. Harlan, of Chicago, who has a gang of men working on it with very satisfactory results.

Mr. Harold A. Wylie of Port Arthur, has closed an important deal for some iron lands near that town, which, it is understood, will soon be developed.

Mr. A. C. Boyce, M.P., is reported to have made a lucky strike at Cobalt, and to have realized profits amounting to from $50,000 to $100,000.

The transfer of the Bruce mines to the Copper and Smelting Co. of Ontario has been completed. The new company, which is capitalized at $1,000,000, is largely English. Extensive operations will be commenced, and these mines, which at one time produced copper of high grade, will again be the scene of great activity.

Work has been commenced near Lake Wahnapitae on the extension of the James Bay Railway from Sudbury to Moose Mountain in the Township of Hutton. This will give an outlet for the rich iron ores found there. The freight charges on that contract will pay the whole of the fixed charges on the James Bay Railway from Toronto to Moose Mountain.

The agreement entered into between the Nickel Copper Co. and the Hospfner Refining Co. for amalgamation has been ratified by both companies, and the latter has now been absorbed by the former.

The *Toronto News* thus hits off the recent mining convention in that city, where harmony did not certainly prevail: "At the Mining Convention:—Moved and seconded, that the Government do everything possible for us and that we refuse to pay a royalty or anything else to the Government. Carried amid wild cheers."

The Arsenical Ore Reduction Co. is developing its property at Grey's Siding, two miles north of Temagami, and has over 50 men at work under Mr. Albert Smith, a New York engineer. The plant is being doubled.

An iron pyrites property at Rib Lake, in New Ontario, is being opened up. A trial shipment has been sent to Buffalo. It belongs to Mr. Smallman, of London.

Mr. J. M. Kilbourne, of Owen Sound, recently appeared before the tariff commission and asked to have the duty on cement increased 10 cents per barrel of 350 lbs. He stated that the cement manufacturing industry in Canada represents a capital of $9,215,000 and gives employment to 10,000 people.

The Windy Arm Mining Co., referred to in the December number of the Mining Review, is now fully organized. It is composed of Toronto people, who have subscribed sufficient capital to develop the claim as soon as the snow goes in the spring. The Conrad mine in the same district, is claimed by Col. Conrad, a well known Montana miner, to be the richest in the world. He says he has arranged to spend a million and a half dollars in development and work will go on all winter. In running a cross cut the vein was struck again. Two more tramways will be built, and the White Pass and Yukon Railway will build a branch to Windy Arm.

Some remarkably rich samples of gold were recently shown at the Bureau of Mines, Toronto, and which Mr. T. W. Gibson, the director, pronounces to be the richest he has ever seen. They were in the possession of Mr. Anthony Blum, president of the Laurentian Gold Mining Co., and were said by him to have been taken from the company's mine near Lake Manitou.

The Canadian Clay Workers Association, which was organized a year ago, held its first annual meeting at Hamilton, on December 13th; when the name of the society was changed to the Ontario Clay Product Manufacturers' Association. The president was requested to interview the Minister of Lands and Mines to urge the establishment of a technical school at the Agricultural College, Guelph, to teach clay working. The following were elected officers for the ensuing year:—Messrs. S. J. Fox, M.P.P., Lindsay, president; J. B. Miller, Toronto and Wm. Hancock, Hamilton, vice-presidents; C. S. Bechtel, Waterloo, secretary-treasurer. Among others who addressed the convention was Prof. Baker, of the School of Mines, Kingston.

The name of The Ontario-Minnesota Mining Company, Limited, has been changed to The Ontario-Duluth Mining Company, Limited.

Mr. W. G. Tretheway, the owner of one of the richest mines at Cobalt, announces that he has arranged to erect a smelter near that town for the treatment of the ores of the district.

The Manitoba Peat Company of Winnipeg, Limited, and the J. B. and J. C. Mining, Development and Smelting Co., extra-provincial companies, have been licensed to do business in Ontario.

The Ontario Government has cancelled a large number of mining leases for default of payment of rent. The leases cover properties in the townships of Drury, Coffin, Trill, McMahon, May, Gilmor, Nairn, Moncrieff, Hyman, Lorne, Salter, Galbraith, Shedden, Craig, Merritt and Haughton in Algoma district; Dryden, Falconbridge, Calvin, Awrey, Hagar, Scadding, Chisholm, Davis and a number of locations near Lake Wahnapitae in Nipissing district; Blake, Gillies, Strange, Dorion, and Papoonge in Thunder Bay district; Jaffray, Haycock, Van Horne, and a number of locations near Rat Portage. On Lake of the Woods and Lake Manitou in the district of Rainy River north. These leases were nearly all granted in the early nineties, for ten years. The amounts in arrears are small, in most cases under one hundred dollars. Of course many of them are worthless for mineral or the holders would not forfeit them for such small amounts. There are a large number more to be cancelled, it is stated about two thousand in all.

MINING IN THE KOOTENAYS IN 1904.

(From Our Own Correspondent.)

The twelve months just passed has been a record year for the mining districts of British Columbia. From the camps of the Boundary country, Rossland, Slocan, Lardeau and East Kootenay there has been exported a total tonnage of over 1,300,000 tons of ore. Boundary's output has largely increased, Rossland has held its own, while the Slocan and East Kootenay have nearly approached the output of the banner year (1900) of lead-silver production in British Columbia. The increase has been due to a variety of causes chief among which, however, may be placed the increased value of the metals, the bounty on lead, the lessening rate of smelter charges, both in respect to copper and lead.

Three-fourths of the total tonnage is derived from the Boundary country and the greater part of that tonnage is due to the enormous output of the Granby mines. It is true that the ores are chiefly low grade, the proportion of high grade ores being even lower this year than last, although the opposite expectation was formed. But the low grade mines are those with the greater permanency and moreover afford steady employment to hundreds of men, not alone in the mining of the ore but also in the smelting, refining and transportation industries. As in the Boundary the smelters treating the ores of those camps are situated in the district itself, it follows that the money expended in mining, transportation and smelting largely remains in the country and helps to upbuild the district. The number of shipping mines in the Boundary has not largely increased during 1905 but much extra prospecting has been accomplished whose fruits will be apparent in 1906. It is for this reason that all the smelters are increasing or are about to increase their furnace capacity. The Granby is now operating eight furnaces; the British Columbia Copper smelter at Greenwood, with two furnaces is doubling this number and the Dominion Copper smelter at Boundary Falls is about to increase its plant in a similar manner.

North and south of the Boundary district, mines situated along the Kettle river and others found westward in the Okanagan and Similkameen are awaiting transportation, which seems likely to be forthcoming immediately, to become productive.

Nor are the prospects of the mines at Rossland one whit less bright, although the district has not been without its troubles. For example the recent concentration experiments have been no more successful than those previously attempted. In December, 1904, it was declared that the costly experiment made by the former management of the War Eagle and Centre Star mines had failed. Apparently this was caused by the manager going directly contrary to the expert advice received. This year the Le Roi has followed suit. It erected an experimental plant on its ground, occupying about the only level spot on the whole of the property, going, necessarily, into the further expense of hoisting its ores. There was no expert in this particular case, the man employed being a "practical man" but the result was the same. The only real success in this direction was accomplished on the Velvet Portland on a 30 ton scale, but being modest has not attracted the attention it merited. The success in this case seems to have been due to the use of hydraulic classifiers, the same idea being successfully carried out on a much larger scale in the Roseberry plant on Slocan lake. However, with a smelter rate of $3 a ton, concentration is not the pressing necessity it was when the rate was $8. The gain in the price of copper, if permanent, should make the difference, especially with the new treatment rate, between profitable and unprofitable ore, in many a mine around the Rossland camp.

As has been already stated the silver lead production has been exceptionally great, the most important producing property being the St. Eugene, but during the year a smelter has been started at Marysville and is treating a large output from the Sullivan mine. At other properties such as the Ranbler Cariboo, the Payne, Slocan Star, Lucky Jim, Monitor, Ajax, Bosun, Bluebell, Higland, Silver Cup, Triune and other extensive development operations have been in progress, while some have also been productive. Production was maintained during the year by over 100 mines, of more or less importance. The price of lead has been one of the causes of the increase but yet another has been the increased facilities provided by the smelters. The new roasting process, known by half a dozen names, for the desulphurization of the ores, was installed at the Marysville plant under the name of the Huntington-Heberlein and similar roasters are in course of erection at Trail and at Nelson, cheapening considerably the cost of reduction. One factor of importance in the improvement that has taken place is the establishment of the Orient as a market for our lead and silver by the C.P.R. Yet another factor is the process, now struggling into perfection, of separating the zinc from the lead. As long as zinc was penalized heavily in the smelters, lead ore which carried much zinc, and such is the case with a large percentage of Kootenay silver lead properties was handicapped. Now with the establishment of the Monitor Ajax Company's zinc works at Roseberry and of the plant at Kaslo, this disability is being removed simultaneously with a rising market in lead and the zinc itself. When zinc was an ingredient to be dreaded in and lead ore, when spelter ruled around $90 a ton, little indeed was thought about the zinc properties abounding in the hills of the Kootenay. To-day things are far different. Spelter has risen to $140 the ton. A mill has been erected at Roseberry which will separate the zinc from the lead. Other will follow. There was a further problem to be attacked and that was the further separation of the iron from the zinc, iron being penalized in a zinc concentrate just as zinc is penalized in a lead ore. Magnetic separation, first started upon the Payne mine, has solved this problem to a great extent, although the last word is far from having been said. A zinc separator is in progress at Kaslo and another is about to be erected by the Monitor Ajax Company, while zinc and iron magnetic separators are in course of construction at Pilot Bay. The latter enterprise is a part of the plans of the Canadian Metals Company which has already partially erected a zinc smelter at Frank. The scheme is to get ore from the lead and zinc mines on or near Kootenay lake, bring them down to Pilot Bay, there separate the lead from the zinc and the iron from the latter concentrates and then ship this zinc, greatly reduced in bulk from the original ore to the Frank smelter. It is hoped that the whole project will take definite form some time during the coming year, much to the lasting benefit of the whole country.

In addition to the districts thus glanced at mention should be made of the Windermere camp where a number of mines such as the Red Line, Paradise, Delphine and others await the construction of the Kootenay Central railroad to begin development and shipping on a large scale.

A further point is that a number of low grade free milling properties seem to be likely to be profitably operated in the future through an adaptation of the cyanide process by Dr. Hendryx, which method has lately been successfully applied at the Reliance mine near Nelson.

COMPANY MEETINGS AND REPORTS.

Consolidated Cariboo Hydraulic.—In his report to the Directors, Mr. J. B. Hobson states as follows:—

"Owing to lack of ample precipitation the past season turned out the most disappointing one experienced since the equipment and opening of the property. The total quantity of water afforded amounted to only 45,071 5-10 inches, which was sufficient to warrant the opening of the mine for regular mining operations.

"The small quantity of water available was, however, used to face up the bank so as to afford Mr. Charles Hoffman, the expert for Mr. John Hays Hammond, an opportunity to test the gold values of the deposits of the upper bench from the floor of the excavation to the surface.

"When the canals were opened and sufficient water accumulated in the pooling reservoirs the water was used at intervals of a few hours each to clear the cuts and sluices of the ice that accumulated therein during the winter months. This work commenced on the 20th day of April, and was completed on the 11th day of May. During the progress of the work, including 74 hours' washing, 8,275 miners' inches of water were used.

"Washing to remove the talus and to face up the bank commenced on the 12th day of May and continued for a period of 354 hours, equal to 14 days and 18 hours' washing. During the progress of the work 36,796.85 miners' inches of water were used to wash out volcanic mud capping from which was recovered 1,268.7 ounces of gold, valued at $21,733.47—an average yield of 11.81 cents per cubic yard. The duty attained for the water used was about five cubic yards per miners' inch per 24 hours."

The following is a summary of the season's prospecting:—

Total time occupied in washing top gravel, 354 hours, or 14 days 18 hours; total quantity of water used washing gravel, 36,796.85 miners' inches; total quantity of top deposits washed, 183,984 cubic yards; average duty of water per miners' inch, washing gravel, 5 cubic yards; average yield per cubic yard washed, 11.81 cents; average yield per 2,500 miners' inches of water used, 24 hours, $1,268.7 ounces; value of gold recovered since 1894, $1,212, 03.04; total value of gold recovered from June 1, 1894, to June 22, 1905, $1,233,936.51.

"The precipitation for the season commencing at close of mining operations on September 4, 1904, and ending June 22, 1905, turned out the lowest recorded for the district since the phenomenally dry seasons of 1864 and 1887. Precipitation for season, 1904, 24.39 inches; precipitation for season, 1905 (rainfall 7.04 inches, for snowfall 6.75 inches), total for season, 13.79 inches; season, 1905, precipitation less than that of 1904 by 10.60 inches; quantity of water available and used during season 1905, 45,053 miners' inches; season of 1905, water supply less than that of season of 1904 by 180.146 miners' inches.

"The rain precipitation occurred in such light showers that only on three occasions, namely, October 20, 1904, .60 inch; May 11, 1904, .68 inch; and May 20, 1905, .75 inch, did it prove sufficient to contribute any water to the reservoir lakes.

"The snowfall, which averaged 67.05 inches on the watershed tributary to the reservoir lakes, went too slowly under the influence of moderately warm days accompanied by northerly winds and temperatures falling under freezing point at night—bad weather conditions for a water supply and accounting for the unusually small percentage of the snow precipitation that was contributed to the reservoir lakes."

"Careful gaugings of the water supply flowing from Spanish lake from November 15, 1904, to date, indicate that the watershed tributary to that lake is capable, even with the light precipitation recorded for the past season, of affording ample water to keep the mine in continuous operation throughout the open season, and the company's water system should be extended with all possible haste to that source of abundant and permanent water supply.

"The 10 ft. x 10 ft. sluice tunnel was advanced 679 feet at a cost of $16.34 per foot, making a total length to face 930 feet, and leaving 300 feet of tunnel and 60 feet of upraise to complete the new opening into the hydraulic excavation, the floor of which is now about 75 feet above the bedrock of the channel. During the months of May and June, several dikes of extremely hard rock were encountered, which interfered with the progress of the work and added materially to the cost thereof. The tunnel and upraise should be completed without delay so as to facilitate the working of the high grade deposits included in the lower bench and on the bedrock and the cutting out of about 4,000 feet of sluice, which is very expensive to maintain.

"The large amount of necessary repairs and development work done during the progress of the past two season's work leaves the water supply system and the mine in as good condition as possible for the continuous use of an abundant water supply; but the mine will not be in first class condition until the sluice tunnel is opened and the bank can be worked in one bench from surface to bedrock.

"The upper gravels washed during the season showed a marked increase in grade indicating that the low grade zone encountered in the current-crossing has been passed.

"A bank blast of about 6,000 kegs of black powder, to cost about $27,000, is strongly recommended. Such a blast would disintegrate and break up ready for economical washing the heavy capping of indurated volcanic mud at a cost not exceeding one cent per cubic yard, as against a cost of about 12 cents per cubic yard to break it up with dynamite and hard labor. The proper disintegration of indurated alluvial deposits tends to increase the washing duty of the water, thereby increasing the gold output, besides working a material reduction in the cost of mining."

The total run last season was only 14 days 18 hours, cutting down the production to 1,268, 4/10 ounces, or $21,733.47.

Le Roi Mining Company.—The Directors submitted the following report at the meeting held on December 8th:—

The accounts show a balance in favor of profit and loss of £49,741. This result is arrived at after paying to the bank £4254 on account of interest and advances, and after writing off £21,345 for exploration and development and £14,139 for depreciation of machinery and plant, surface improvements, etc., at the mine and smelter. In the year there were fortunately extra profits (1) of about £10,000 owing to the receipt of a better price for matte at Tacoma under the contract arranged by Mr. Wilson and approved by Mr. Mackenzie; (2) of about £7000 by reason of the increased price of copper, and (3) of about £2000 owing to the decreased price of coke. The ore mined was of higher value than in the previous year by $1.47 per ton, or, say, £34,843 on the tonnage mined during the year, and was produced more especially from the 700 ,800 and 900 foot levels.

The accounts show that the liabilities at June 30 amounted to £54,394 and the liquid assets amounted to £125,483. This is an improvement in surplus liquid assets upon the previous year of £56,886, and is largely owing to the advantage of sending matte to Tacoma under the contract, which made the proceeds immediately available, instead of waiting several months, as heretofore, when shipped to New York.

The board regrets to have to state that the important body of high grade ore referred to in the previous report as having been discovered in the 1450 level, averaging $30 per ton in value and nine feet in width, has out been productive of the results that were then expected, only 3011 tons having been extracted below the 1350 foot level from November, 1904 to June 1905, and 1422 tons during the following three months. The gross value of the 4433 tons, made up of the two above amounts, was $88,407, and the total expenses were $72,249, leaving a net profit of $16,158. The proportion of richer ore thus obtained, though raising the general value of the ore mined, bears very little upon the profits, inasmuch as the total amount of ore reported to have been raised during the fiscal year was 114,960 dry tons.

The small experimental plant for treating the value of water concentration ordered by the board, and referred to in the previous report as in process of erection by the company under Mr. McMillan at Rossland, commenced running on July 1 and has not, unfortunately, answered the expectations which were entertained in regard to it. Instead of $13,000 which it was expected to cost, $33,049 has been laid out upon it. Mr. Mackenzie was obliged to shut it down as it was not adapted for the work required.

During the whole of the year the ores from the mine were sent by Mr. McMillan to the Northport smelter in place of the Trail smelter as advised by Messrs. Bradley and Mackenzie, with a direct loss in one year, on the statement of the company's accountant at Rossland, through continuing to use the smelter, of $109,575. It was in these circumstances, and upon the authority that the directors entered into a contract with the Canadian Smelting Works.

The ore reserves are unfortunately low. They were estimated by Professor Brock, of the Dominion Government Geological Department, in January, to be 124,000 tons, but Mr. Astley reports that the deposits are very irregular and "spotty," and at the close of the year Mr. Astley "found it impossible to accurately estimate them." Mr. Astley and his foreman, Mr. Trevarrow, reported to Mr. Mackenzie on Sept. 1 that the ore reserves did not exceed at that date 39,000 tons, containing gross values of $10.68 per ton. Mr. Mackenzie states that the ore reserves in the Le Roi have never been so low as at present, and an immense amount of development work will be necessary during the coming year.

In the last report the directors referred to the question of consolidation of interests with other companies and to the commencement of negotiations for that purpose, which were naturally expected to occupy a considerable period of time. The companies proposed to be amalgamated with the Le Roi Mining Company are: The St. Eugene Consolidated Mining Co., Limited, the Centre Star Mining Co. Limited, including the War Eagle properties; the Canadian Smelting Works at Trail, including the Rossland Power Company.

Mr. Mackenzie's report contains not only his opinion that the proposed amalgamation is desirable in the interests of the Le Roi Company, but also his recommendations as to the proportions which he considers to be fair and reasonable between the different companies to be amalgamated. Mr. Mackenzie concludes his report as follows: "I would recommend the Le Roi Company to enter the consolidation on the terms previously stated, firmly believing that there is no question of doubt as to the results being beneficial to the shareholders." It will be easily be understood that the progress of these negotiations has formed a matter of constant consideration not unmixed with anxiety to the board. They have all along felt that the results in the working of the Le Roi mine from time to time were precarious, and that the expectations occasionally held out to them were far from being realized. They have thus been forced to the conclusion that it would undoubtedly be to the interests of the Le Roi shareholders to participate on equitable terms in the working of a strong and prosperous company as was generally approved at the last meeting.

The directors therefore strongly advise the shareholders to adopt the recommendations of Mr. Mackenzie, which they themselves believe will, if carried out, result in the earning of regular dividends in the future. In the report of Mr. Mackenzie the proposal, so far as the Le Roi shareholders are concerned, is that they shall receive in exchange for their shares 24 per cent. in the capital of the new company to be formed, and, without including the value of cash and stores, he estimates that a dividend of no less than 19 per cent. per annum will be earned by the combined companies on a capital of $4,000,000, equal to, say, $800,000.

If however, the proposed amalgamation is carried out according to the present intentions, the capital of the combined company will be £1,200,000, of which £1,100,000, representing the amount referred to by Mr. Mackenzie in addition to values of cash and stores of the various companies, will be divided proportionately between the various companies and £100,000 will remain unissued, and will be available for taking further properties into the amalgamation or for other purposes. The Le Roi Company would be allotted as its share, 24 per cent. of this capital, amounting to £264.000, on which regular dividends of 14 per cent. or say £37,000 a year, might be expected and this in a new company not overburdened as the Le Roi Company has hitherto been, with an excessive capital. A sum would it is expected, be realized by the Le Roi Company in cleaning up the Northport smelter and for cash and stores of, say, £60,000. Out of this £30,000 will be paid as a cash working capital to the new company, and the balance of, say £30,000 will be available for distribution amongst the Le Roi shareholders. In addition to the Le Roi contribution of £30,000 the other companies will similarly contribute their proportions, which will amount to £95,000, and the new company will thus start with a working capital of £125,000, which it is considered will be sufficient to carry on its operations in the best possible way.

Mr. Aldridge who will be responsible for the management of the new company, and who is intimately acquainted with the various properties, reports that in the past year the St. Eugene Company earned a net profit of $575,827, and had in its treasury in cash $372,000; the Centre Star Company, which since negotiations have started has absorbed the properties of the War Eagle Company, earned a net profit of $144,846, and had in its treasury and in cash due, $217,254; and the Canadian Smelting Works earned a net profit of $188,850, and had an earned reserve of $223,496. So the above Canadian companies had altogether a net profit of $909,523 in the year and a surplus of cash on hand of $812,938.

The great advantages to be derived from this amalgamation are fully set forth under the following six headings in Mr. Mackenzie's report: (1) A reduction in the cost of mining and exploration; (2) a substantial saving in administrative and office expenses; (3) reduction in freight and treatment charges;(4) reduction in present cost of marketing copper; (5) competent management and skillful direction of exploration work under one head; (6) the prestige and advantages of a large and powerful corporation with sufficient capital to assure the future, backed by the support of a great transcontinental railway vitally interested in the upbuilding of a profitable mining and smelting industry in British Columbia.

At the meeting the resolution adopting the report and accounts was carried unanimously, but when a second resolution was put to the meeting to agree to the scheme of amalgamation, it was lost by a large majority.

The Chairman thereupon demanded a poll, which he said would be taken by voting papers being sent to the shareholders, who would be asked to return them within a fortnight.

The motion to re-elect Mr. Waterlow, a director, was also negatived, and resolutions re-appointing Mr. MacMillan and the three gentlemen mentioned by him as directors, were carried, the Chairman demanding a poll in each case.

MINING NOTES.

ALBERTA.

Oil has been struck in one of the wells of the Western Oil & Coal Company, which owns a large tract of land in South Western Alberta.

BRITISH COLUMBIA.

Boundary.—It is announced that the British Columbia Copper Company is about to make a further large expenditure, increasing the capacity of its Greenwood smelter to 300 tons daily, and contracts have recently been let to the Power & Mining Machinery Company for the building of three blast furnaces 84 x 240 inches, having a combined capacity of 1,800 tons daily. These changes will also necessitate the enlargement of the ore bins, and a machine shop will also be added. The contract for additional electrical equipment has been placed with the Canadian Westinghouse Company and consists of a 500 horse power motor to drive the compressor plant at the Mother Lode mine and three 50 kw. stepdown transformers.

For the smelter department have been ordered three 300 horse power motors to drive the large new blowers, an additional

100 kw. motor generator, besides several smaller motors. In addition there are five trolley locomotives for hauling ore from the bins to the blast furnaces and the slag to the waste dump.

With the completion early in the spring of the new service into the Boundary district of the West Kootenay Power & Light Company, additional electric power of 60,000 volts will be utilized at the smelter and mine.

Slocan.—The case of the Lanyon Zinc Company *vs.* the Payne Mining Company was recently settled out of court, each side agreeing to pay its own costs.

Rossland.—A contract has been let for carrying the winze from the 1,550 ft. level at the Le Roi, down to the 1,750 ft. level. It is proposed, should this ground prove as rich as expected, to deepen the main shaft from the 1,350 ft. level.

On December 17th a tremendous explosion of powder occurred at the Centre Star mine, killing Mr. J. Ingraham, formerly Chief of Police of Rossland, and causing considerable damage to the mine buildings in the vicinity.
Add British Columbia Mining notes———

Lillooet.—The Iowa & Lillooet Gold Mining Company's dredge, which has been in operation during the past season on the Fraser River, below the town, is said to have made a very satisfactory showing, the average daily recovery having been in the neighbourhood of $100.00. During the year placer mining was carried on at Cayoosh Creek, Alexander Creek, the north fork of Bridge River and on the south fork of Bridge River, and Cadwallader Creek. The Lorne mine was also worked, good values being recovered from the ore which was crushed in an arrastra.

East Kootenay.—A 2 per cent. dividend was paid to shareholders of the St. Eugene Company on January 8th. The earnings of the mine during 1905 were over $500,000.00, of which sum $28,000.00 was distributed as dividends in quarterly amounts at the rate of 2 per cent.

Nelson.—It is reported that a number of iron claims on Crawford Creek have been sold to a syndicate of Cleveland and St. Paul purchasers.

Atlin.—Referring to reports in the *Victoria Press* that the day of the individual miner in Atlin is practically over, the *Atlin Claim* emphatically denies the statement. Our contemporary states as follows:—These views are simply a re-hash of the stuff with which the coast papers are deluged every fall by company managers, company promoters and their hangers-on. These gentlemen have the stage all to themselves as the individual miner stays at home and works to keep up the annual gold output. If the Minister of Mines report of the output was dependent on the results achieved by the majority of the companies, Atlin would cut a very sorry figure. The individuals, proportionately, are taking out the most gold and the interviews that emanate from company promoters claiming that the day of the individual miner is over are ridiculous. The wish is father to the thought.

NOVA SCOTIA.

During the month of December the Dominion Iron & Steel Company made a very remarkable showing. The blast furnaces produced nearly 21,000 tons of pig iron; the open hearths, which at the beginning of the year were producing about 10,000 tons of steel, last month, turned out over 20,000 tons. The rail mill whose previous best record was less than 8,000 tons, made last month 10,000 tons. The output of the rod mill was 6,700 tons of wire, notwithstanding the fact that it was idle for two shifts, thus beating the Sharon mill record of 6,200 tons. In this regard, a 25,000 ton order from the Grand Trunk Railway Co., one of 5,000 tons from the Temiskaming Railway of Ontario, and one of 25,000 tons for the Intercolonial Railway of Canada have been completed. An additional order of 37,000 tons from the Grand Trunk, besides a heavy order from the Canadian Pacific, have been accepted for the new Year. With a view to to the largest winter's output of iron and steel in the history of the plant, the company during the year made the greatest importations of iron ore and limestone on record, the quantity of the former material brought from iron ore mines at Wabona alone amounting to over 400,000 tons, against a little more than half that amount in former years. At present the company have three thousand men on the payroll of the Sydney plant and this is the largest number of hands employed since manufacturing operations were commenced.

ONTARIO.

Mr. E. T. Corkill, who recently visited the Algoma district, reports that a new concentrating mill, with a capacity of about 60 tons per 24 hours, has been installed at the Superior Copper Mine. The plant includes a three-compartment hydraulic separator and four No. 4 Wilfley tables. It is stated that the Elmore oil plant at the Massey Station copper mine has treated about 3,500 tons of ore during the past year, and has succeeded in recovering copper values to the extent of from 75 to 80 per cent.

The Lake Superior Company recently contracted to supply the C.P.R. with 60,000 tons to steel rails, to be delivered this year.

At the session of the Tariff Commission, held at Sault Ste. Marie on December 21st, the Lake Superior Corporation asked that a duty on coal for coking purposes, amounting to 53 cents per ton, be removed. It is urged that if this tax be removed, large coke works will be established on the Canadian side of the line. The company's steel plant uses 500 tons of coke per day.

Two big gushers are reported to have been struck in the Leamington Oil Fields on December 9th, one on the property of the Leamington Oil Company, which flowed ten barrels an hour, and the other on Concession 7, which has been flowing about 3,000 bbls. per day.

Mining operations are to be carried on extensively at the Aitakan iron mines this winter, and arrangements are now being made to install the necessary machinery on the properties. Operations will be carried on under the direction of Mr. J. C. Hunter.

A very rich strike of ore is reported to have been made at the Laurentian mine, which was recently re-opened, a blast at the 85 ft. level disclosing a great mass of visible gold in the quartz.

During the month of November the Big Master mine produced gold to the value of $3,000, as a result of 30 days crushing. The concentrates were estimated to be worth $800.

In the Cobalt district several claims have recently been sold for good prices. Thus a claim on Cross Lake was sold to the Imperial Mining Company for $60,000; the McLeod and Glendenning mines were sold for, it is reported, $250,000, and two or three other properties have been purchased at equally high prices.

Mr. Smith, Inspector for the Temiskaming Mining Division, states that since April 5th, he has issued 1,000 licenses for the division. There is every indication that next spring the rush to the mining fields of the division will be greater than at any time this year.

YUKON.

The Mining Committee of the Yukon Council is now engaged in drawing up a code of mining laws, which will be acceptable to those operating in the territory. Several meetings have been held of late, and there has been a singular unanimity of view as to the main points requiring amendment in the present mining law. It is the intention of the Committee to submit its recommendations to Ottawa, when it will be brought down in the form of a bill, to be presented at the next session of the House

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MINING MEN AND AFFAIRS.

On Nov. 28th, Mr. J. F. Halloran transferred his entire interest in the *Mining and Scientific Press* to Mr. T. A. Rickard, lately editor and part owner of the *Engineering and Mining Journal*, New York. It is the intention to maintain the high character of the paper and to keep it in its position as the representative mining journal of the *Great West*. Mr. Edgar Rickard, of Berleley, is already business manager. Mr. T. A. Rickard will assume active editorship on the first day of 1906. Mr. Arthur H. Halloran, son of the former proprietor, will be one of his assistants. Several of the leading writers in the profession have undertaken to contribute practical articles bearing upon mining and metallurgy. As both the editor and the business manager are mining engineers by training and familiar with the chief mining regions of the world, it is expected that the *Mining and Scientific Press* will gain in interest to its readers and in usefulness to its advertisers.

The secretary of the Canadian Society of Civil Engineers has addressed the following circular to members:—

"On the invitation of members residing in Toronto, and by resolution of the Council, the annual meeting of this Society will be held in Toronto, during the fourth week in January. It is expected that special railway facilities will be available for members attending the meeting. A detailed programme will be forwarded to you early in January."

Mr. Alex. Dick, General Sales Agent of the Dominion Coal Company, recently returned from an extensive tour of the American and Canadian coal fields. Mr. Dick states that the coal trade is in a very flourishing condition, the Dominion Coal Company's output last year having been a record achievement.

Mr. R. H. Anderson has been appointed mine manager at the Sullivan mines, East Kootenay, B.C.

Mr. J. H. Plummer, President of the Dominion Iron & Steel Co., recently left for a brief sojourn abroad. Prior to his departure Mr. Plummer stated that the company is now maintaining an output at the rate of 20,000 tons of pig iron per month, all of which is being converted into steel. This tonnage, however, is certainly gaining and I believe it will reach 25,000 tons by spring. The prices, while fair at Sydney are not high when compared with those in the States. From the large orders on hand and being received there is no doubt about the rail mill being fully occupied. The heavy demand is no doubt caused by the open hearth rails proving to be of a superior quality.

Mr. Geo. A. Walkem, who for over four years past has acted as manager of the Vancouver Engineering Works, has resigned his post. Before leaving Mr. Walkem was presented with a handsome testimonial by the employees of the company.

Mr. W. French, Mechanical Superintendent of the Hall Mines smelter at Nelson, B.C., was presented by the employees on Christmas Day, with a gold watch and chain, in token of their regard and esteem.

COMPANY NOTES.

Tilt Cove Copper.—The secretary has issued the following circular to shareholders, dated November, 30th:—I beg to inform you that at a meeting of the members of the Committee of Management of this company, held to-day, it was resolved—"That an interim dividend of 3s. per share be and is hereby declared on the shares of this company, free of income tax, payable on the 5th day of December, 1905, to the shareholders on the books of the company on the 4th of December, 1905, and that the transfer books be closed during the said 4th day of December, 1905. Holders of share warrants to bearer are informed that coupons No. 7 will be paid at the above rate, free of income tax, on presentation at the company's office. In sending you this notice of interim dividend the committee desire to point out that this dividend is based on the profits for eight months, namely, from 31st December, 1904, to 31st August, 1905, which includes the realization of the large stock of ore brought forward from 31st December, 1904."

Le Roi.—"November shipments amount to 8,000 tons, containing 2,550 ounces of gold, 4,350 ounces of silver, 187,600 lbs. of copper. Estimated profit on this ore, after deducting cost of mining, smelting, realization and depreciation, $17,000. Expenditure on development work during the month, $9,000."

New Velvet Portland Mine, Limited.—Registered November 18, by C. W. Brown & Aylen, 2 Gresham Buildings, E.C. Capital £10,000, in £1 shares. Objects:—To acquire, prospect, examine, explore, and work any property or ground supposed to contain gold or minerals in Canada or elsewhere, in particular to take over the undertaking and all or any of the assets in British Columbia of the Velvet Portland Mine, Limited; to adopt an agreement with W. Trotter and C. W. Brown; and to carry on the business of gold and general miners, metallurgists, &c. Minimum cash subscription, 10 per cent. of the shares offered to the public. The first directors (to number not less than two nor more than five) are: E. H. Clarke, A. Maclean, and W. J. Newhall. Qualifications of subsequent directors, one share.

Tyee Copper (Vancouver Island).—November: Smelter ran 11 days, and smelted—Tyee ore, 2,304 tons; Customs ore, 265 tons; total, 2,569 tons. Matte produced from same, 220 tons. Gross value of contents (copper, silver, and gold) after deducting costs of refining and purchase of Customs ore, $31,062.

Dominion Copper Company, Ltd.—The following circular has been issued to shareholders:—Pursuant to the plan of reorganization under which the Montreal & Boston Consolidated Mining & Smelting Company, Limited, (hereinafter called the Consolidated Company) conveyed its properties to your company the new board of directors was elected on July 28, 1905, and thereupon assumed the management of your company.

The contemplated issue of bonds, amounting to $700,000, was at once consummated. Out of the funds received from all sources, including the bond issue, your company has paid (1) the balance amounting to $339,158.79 due under the so-called "Dominion" agreement for the purchase of stock of your company; (2) a large amount of debts of the consolidated company, which were specifically assumed by your company; (3) the charges incident to the reorganization and the expenses of general administration; and (4) about $50,000 for equipment, supplies, labor and other outlays in developing the mines of the company, and preparing to start the smelter.

The company now has balances in bank aggregating about $115,000; and has mining and smelting supplies worth about $30,000.

The assets acquired by your company comprised among other properties, a large majority of the capital stock of the Montreal & Boston Copper Company, Limited, which owns the smelter. After the present management assumed charge of your company in July last, Messrs. Munroe & Munroe asserted against the Montreal & Boston Copper Company a claim, amounting to about $17,000, for alleged services and advances to that company. The claim is being vigorously defended. The Crow's Nest Pass Coal Company also asserted a claim against the Montreal & Boston Copper Company amounting to about $20,000 for coke alleged to have been furnished to that company about two years ago. In addition, there have been asserted against that company claims amounting to about $7,000 for legal services alleged to have been performed by Canadian and New York lawyers, and other claims aggregating over a thousand dollars. A Canadian firm of lawyers also demands $3,068.70 for alleged services to the Consolidated Company.

The assertion of these claims came as a surprise to the present management. Careful investigations regarding them were at once instituted. While claims against the Montreal & Boston Copper Company are not liabilities of your company, it is claimed, they are so far as valid enforceable against the smelting property, and may have to be taken care of in some way.

Your company appointed Mr. Samuel Newhouse as general manager of the mining operations of the company and employed Mr. M. M. Johnson as consulting engineer. The work of developing the mining properties of the company has been actively taken up. The smelter of the Montreal & Boston Copper Company not having been properly cared for was found to be in an unsatisfactory condition, and required extensive repairs. It is not properly located or equipped to treat the ores economically for any great length of time. Preparations have been made, however, to start it. About 50 men are now employed at the mines and smelter, and when the smelter is in operation about 200 men will be employed.

It is the intention of the management, acting under the advice of the general manager and consulting engineer, to ascertain as nearly as possible the character and volume of the ores in the various mines, and thereupon to determine to most expedient methods of handling and treating the ores. In order to obtain accurate and reliable conclusions in regard to these matters it seems necessary to operate the smelter for some period at least. The smelter has been put in repair, and it is expected that it will be blown in by the first of December, and will be capable of treating from 600 to 700 tons of ore per day.

MINING STATISTICS.

BRITISH COLUMBIA:

J. W. Harrison, in his report of the California Coal market for November, states that British Columbia deliveries during that month were 36,427 tons. The coal deliveries at San Francisco during 1905 are estimated as being fully 30 per cent. below the quantity received in 1904.

The production of the Vancouver Island mines is given as follows:—Wellington collieries, 60,893 tons; Western Fuel Company, 89,285 tons. The *Phœnix Pioneer* states that the production of the Boundary district for the year reached the large total of 949,140 tons, of which the Granby mines contributed 665,000 tons, the B.C. Copper Co., 178,000 tons; the Brooklyn-Stemwinder, 54,000 tons, and the Raw Hide, 27,000 tons.

The output of the Crow's Nest Pass Coal Co. for 1905 was as follows:—

	Tons.
Coal Creek Mines	429,382
Michel mines	311,071
Carbonado Mines	95,170
Total	835,623

The Fernie coke ovens produced 127,062 tons; the Michel oven 127,037 tons, and the Carbonado ovens 7804 tons, making a total for the year of 261,933 tons, which at $4.50 per ton realized $1,178,698.50. It takes 100 tons of coal to make 60 tons of coke, so that the 261,933 tons of coke produced represents 436,555 tons of the total coal output leaving 399,068 tons of coal, which at $2 per ton brought into the treasury $798,136, making a total revenue for the year just closed of $1,976,834.50.

Total shipments of coal by Western Fuel Company for the year 1905 were 169,874.05, divided as follows: January, 16,855.14; February, 16,530.10; March, 24,519.07; April, 28,510.09; May, 21,004.00; June, 3,354.00; July, 1,520.17; August, 1,211.05; September, 2,042.10; October, 10,447.00; November, 24,199.14; December, 27,260.07.

Shipments of ore over the Kaslo & Slocan Railway, from eighteen shipping mines for the year, is said to have been 11,580 tons, valued at $273,700.00, of which the zinc contents represented 42.6 per cent.

The lead returns from the Hall mines smelter for November show over 1,000 tons of lead ore received and nearly 300 tons of lead contents, notwithstanding the fact that no ore was received during the month from the St. Eugene mine. The chief lead shippers in order were the Alice, Whitewater, Reco, Emily, Edith and Highlander.

The lead returns from the Trail smelter for the month of November showed lead contents of ore treated as having been rather over 150 tons; 500 tons of lead ore were received.

The *Rossland Miner* publishes the following table of ore shipments for the year:—

	Tons.
Le Roi	113,566
Le Roi (milling)	3,240
Centre Star	96,630
War Eagle	66,909
Le Roi Two	9,472
Le Roi Two (milled)	10,630
Jumbo	10,729
Cascade-Bonanza	150
White Bear	1,100
White Bear (milled)	3,220
Crown Point	350
Spitzee	4,809
Velvet-Portland	1,977
Gopher	180
Homestake	30
Lily May	90
Inland Empire	30
Total	323,112

NOVA SCOTIA.

The *Morning Chronicle* estimates the value of the coal output of the province, for the year 1905, at $11,250,000; coke, $650,000; gold, $320,000; iron ore, $80,000; other minerals, $620,000; pig iron, $3,500,000; steel, $3,800,000; and steel rails, $1,500,000. The coal shipments were the largest on record.

During the year 1905 the Nova Scotia Steel and Coal Co. produced 560,000 tons of coal, 120,000 tons of coke, 58,000 tons of pig iron, and 22,000 tons of steel. These are the largest figures in the history of the company.

The record made by the Dominion Steel Co. the past year has been very satisfactory. The total production of pig iron was 162,000 tons, of the open hearth steel furnaces 173,500 tons and of the rolling mills 47,000 tons. Of eighty-pound steel rails, 44,000 tons have been already turned out. The production of coke amounted to 242,150 tons. Over half a million tons of coal was consumed by the company in its different operations, as well as 380,184 tons of iron ore, 267,237 tons of limestone and dolomite and 13,711 tons of gravel and sand. During the height of the season 4,000 men were employed by the company, and the payroll exceeded $2,000,000. Perhaps the most important announcement that the company has to make is that it has advanced from being a mere purveyor of raw materials to the position of a producer of finished materials. At the beginning of the year six open hearth furnaces were in operation. This number was gradually increased until the whole ten were in use, in September and the remaining months of the year. The company's wire rods are considered of fine quality and now have the Canadian market captured.

Returns for the Dominion Coal Company for the month of December were as follows:—

Dominion No. 1	34,899
" No. 2	42,355
" No. 3	14,415
" No. 4	32,687
" No. 5	36,032
" No. 6	3,061
" No. 7	8,644
" No. 8	10,209
" No. 9	15,665
	198,017

Shipments, 187,598.

During the month of November shipments from the respective collieries were as follows:—

	Tons.
Dominion Coal Co., Ltd.	278,856
Cumberland R'y & Coal Co.	40,473
Acadia Coal Company	22,670
Intercolonial Coal Co.	23,617
N.S. Steel & Coal Co.	59,108
Inverness R'y & Coal Co.	11,593

ONTARIO.

The Bureau of Mines reports that the output of the metalliferous mines and works of the province for the nine months ending September 30th, are as follows:—Gold, $67,259; silver, $1,300,000; nickel, $2,531,000; copper, $522,746; cobalt, $75,000; iron ore, $157,640; pig iron, $2,207,864; steel, $2,421,549; arsenic, $2,400. The shipments from the mines in the Coleman township area amounted to 1,802 tons, the contents of which, stated separately, were as follows:—Silver, $1,300,000; cobalt, $75,000; nickel, $6,100; arsenic, $2,400. Total, $1,383,500. Making allowance for the conversion of pig iron into steel, the total value of the metalliferous output for the nine months was about $9,000,000. For the whole of 1904 it was $5,061,677, so that the rate of production during the present year is more than double that of 1904. The present year will be the record one for the production of nickel in Ontario. The output for the nine months is already in excess of the total yield for 1903, which up to the present time showed the largest output.

MINING INCORPORATIONS.

ONTARIO.

Sovereign Cobalt Mining Company, Ltd.—Capital $200,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional directors: Messrs. Joseph Marsland Horrocks, William Andrew Smiley and Frank Joseph Stanley.

Canadian Forty-Mile Gold Dredging Company, Ltd.—Capital stock $600,000.00, in shares of $100.00 each. Head Office, Toronto.

Ontario Cobalt Developing Company, Ltd.—Capital $350,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Messrs. Stephen Moffatt Hay, James Walter Curry, Jos. Bingeman, James Kenniston Paisley and Elmer Eugene Wallace.

The Pittsburgh-Cobalt Company, Ltd.—Capital $75,000.00, in shares of $10.00 each. Head Office, Toronto. Provisional Directors: Messrs. Chas. D. Robbins, Sydney Frederick Heckert, Wm. Alfred McCutcheon, Harrison Orville Patch and Samuel McElroy.

Toronto Cobalt Mining Company, Ltd.—Capital $300,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Messrs. Hamilton Bender Wills, Whitford Vandusen and John Samuel Humberstone.

RECENT PUBLICATIONS.

Report of the Klondike Gold Fields, by R. G. McConnell, B.A., Pt.B., Annual Report, Vol. XIV, Geological Survey of Canada, Ottawa, 1905. This report is based on field work carried on during the season of 1903. Parts of the preliminary report on the district, published in 1900, are also incorporated in the present report.

Report on the Geology of a Portion of Eastern Ontario, by R. W. Ells, LL.D., Pt. J. Annual Report, Vol. XIV, Geological Survey of Canada. This report should accompany carbon sheet 119, compiled by Mr. Jos. Keele, B.A., Sc., and deals with the geology and mineral resources of the large area contained therein.

Report of the Bureau of Mines, Ontario, 1905, Vol. XIV, Pt. I, Toronto, 1905. This voluminous report is comprised in a volume of 375 pages, and is divided into chapters, the first being a statistical review of mining conditions in the Province for the year 1904, the second, an account of the summer mining classes, by Dr. W. L. Goodwin, while the mines of Western Ontario are discussed by Mr. W. E. H. Carter; the mines of Eastern Ontario, by Mr. E. T. Corkill, who also contributes a chapter on "Petroleum and Natural Gas." Mr. P. Gillespie writes on the cement industry of Ontario, while there is an account of the explorations in Abitibi, by Mr. J. G. McMillan; a chapter on the Loon Lake iron-bearing district, by Mr. W. N. Smith, and on the Boston Township iron range, by the Provincial Geologist, Mr. W. G. Miller; and a long and interesting report on the iron ranges of Michipicoten West, by Mr. J. M. Bell.

The total mineral production (metallic and non-metallic) of Ontario, during 1904, was valued at $11,572,647.00. This, rather less than five million dollars, represented metallic production.

The Nature of Ore deposits, by Dr. Richard Beck, Professor of Geology and Economic Geology, Freiberg Mining Academy, translated and revised by Walter Harvey Weed, E.N., with 272 figures and a map, 2 Vols., first edition, The Engineering and Mining Journal, New York and London, 1905. We have received a copy of this valuable work, a comprehensive review of which will appear in a future issue.

The Colliery Manager's Pocket Book, 1906. We have received from the publishers, The Colliery Guardian Company, Ltd., London, E.C., a copy of this useful pocket book and diary, which is now in its 37th year of issue. The book contains much useful information of a character required by engineers and others engaged in working coal mines.

NOVA SCOTIA MINING INTELLIGENCE.

Our special correspondent sends us the following list of areas applied for during the month of November:—

DISTRICT.	AREAS.
Stormont	227
Oldham	20
Little Beaver Lake	30
Montague	29
Malaga	6
Brookfield	46
Salmon River	233
Sheet Harbour	46
Shiers Point	6
Kemptville	26
Gold River	3
Renfrew	9
Chezzetteook	12
Mills Village	18
St. Pauls Brook	20
Lake Catcha	15
Total	746

In November the Anderson mill at Lake Catcha crushed 29 tons quartz, which yielded 23oz. 17dwt. 0grs. gold. In November at the Taylor mill, Oldham, 531 tons quartz crushed yielded 547oz. of gold.

METAL MARKET CONDITIONS.

COPPER.—In a recent circular Messrs. Morrison Kekewich & Co., of London, write as follows:—

Copper conditions are very strong and most interesting, and there has been active trading, as prices have advanced. Cash standard is £2 higher, and three months £1 15s. The position now is acute, consumption is increasing and already larger than even the increased production can keep pace with. Electrical and other demands are taking very large quantities. There is now no available copper before March-April, and consumers are in an awkward position. There are no stocks anywhere, and the short selling has been chiefly done by those who have no knowledge of the real situation, which has been developed so strongly and promises to continue even more so.

In their med-monthly report on copper, Messrs. Jas. Lewis & Sons write:—

The dearth of copper has become very acute, and great difficulty is experienced by manufacturers in obtaining necessary supplies for delivery during the next two or three months. For prompt and early delivery excessive prices are being paid, and full prices for delivery in three or four months. The covering of "bear" sales forced up the value of standard copper to £81 for January delivery and to £80 for three months' prompt on the 14th inst.—an advance of £3 5s. on early and £2 10s. on forward delivery since the 1st inst.—but the pressure of sales to realize profits reduced it to £80 and £79 2s. 6d. on the 15th; the closing value to-day is £79 2s. 6d. and £78 15s. 0d. For best selected ingots £88 10s. has been paid—the highest price for many years. English high conductivity wire bars are not obtainable for delivery before March, while American wire bars only offer for April delivery at £87 per ton, 18½ cents per lb. having been paid by American consumers for delivery up to May; the quotation for Lake being 18½ to 19 cents per lb., though a sale at 19¾ cents is reported. Large sales of Japanese copper continue to be made to Europe for delivery in three to six months' time, and it was reported on the 7th inst. in well-informed quarters in New York that of the copper purchased there and shipped to China some 20,000 tons had been resold to Europe at prices 30s. to 60s. per ton below the prevailing quotations. Leading authorities, however, deny that the quantity sold is as large as 20,000 tons, but undoubtedly a considerable quantity will be shipped from China to Europe. The prevailing "famine" may therefore continue for another two or three months, but after that time it will probably be relieved by the receipt of additional supplies from Japan and China. Larger shipments to Europe may also be expected from the United States as no more copper is likely to be shipped to China for some time to come, and it is very doubtful if the recent apparent increase in the home consumption (as shown by the following figures) will continue, good part of it being probably due to delay in forwarding ore and fuel from the mines and collieries to the smelting works in consequence of the temporary scarcity of railway wagons. Undoubtedly the present high value of copper will greatly stimulate its production, while it will reduce its consumption in some directions—notably in the manufacture of sulphate of copper. The production of copper in the United States is this year believed by those best qualified to judge, to have increased about 12½ per cent. over that of 1904.

The latest New York quotations are:—lake, 18½ at 18⅞; electrolytic, 18⅝ at 18⅞; casting copper, 18¼ at 18⅝.

LEAD.—The London market continues to show strength, English lead being quoted at £17 11s. 3d.; Spanish lead, £17 10s. The American Smelting and Refining Co. has recently fixed its price at 5.60 New York and 5.52½ St. Louis.

SPELTER.—London quotations are £28 15s. at £29. Recent sales in the St. Louis market have ranged from 6.47½ at 6.50 Zinc has been selling in sheets f.o.b. cars Lasalle and Peru widths from 32 to 60 in., and lengths from 84 to 96 inches at $7.75 per 100 lbs.

SILVER.—Prices last month ranged from 65¼ to 65¾.

IRON AND STEEL.—The *Engineering and Mining Journal* states that foundry iron is quiet and prices unchanged. For northern iron the following prices are quoted:—No. 1X, $19 at $19.25; No. 2X, $18.25 at $18.75; No. 2 plain, $17.75 at $18.25; gray forge, $16.50 at $17; Virginia foundry is held at $18.60 at $19.10 for No. 1, and $18.25 at $18.75 for Alabama, $18.60 at $19.10 for No. 1, and $18.10 at $18.60 for No. 2. Basic has been $18.25 at $18.75 for Alabama, and 25c. less for Northern. For Southern iron, on dock, quotations are: No. 1 foundry, $18.75; No. 2, $18.25; No. 3, $17.50; No. 4, $17; No. 1 soft, $18.75; No. 2 soft, $18.25; gray forge, $16.50. Southern prices are firm, and a little extra is asked for special deliveries, especially on No. 2 soft. Prices for cast iron pipe are steady on a basis of $28.75 per net ton for 6-in. pipe, carload lots at tidewater points.

Iron bars are 1.845 at 1.895c. for common and 1.945c. for refined. Still higher prices are expected. Steel bars are 1.745c., tidewater. Store trade is done at about 2.50c. for iron and 2.25c. for steel. Steel plates are still in strong demand. Tank plates are 1.745 at 1.825c.; flange and boiler, 1.845 at 1.945c.; universal and sheared plates, 1.745c. up, according to width.

STEEL RAILS.—No change in standard sections. Light rails are in demand, prices ranging from $26 for 35-lb., up to $33 for 12-lb. rails. Girder rails are not in request just now, in this territory.

MINING AND INDUSTRIAL SHARE MARKET.

(Specially Reported by Messrs. Robert Meredith & Co. Montreal.)

The market for mining stocks is gradually undergoing a change, and there is now a considerable enquiry for many of the stocks in the Rossland district.

The consolidation of the War Eagle with the Centre Star, and the report of an ore strike in the latter mine has created a quiet demand for the stock of this property, and has also brought enquiries for other stocks, which for a long time past have been almost forgotten.

In the Boundary district the Granby Consolidated is the only stock in which there is any trading, but in the eastern district the Silver Lead properties are now looking up; in spite of the disaster, the St. Eugene has paid its quarterly dividend as usual, and this has drawn attention to this property, and Canadian Gold Fields Syndicate.

Amongst the industrials the common stock of the Dominion Iron & Steel has been the feature, and there has been quite a big speculation in it.

Nova Scotia Steel has also participated in the improvement of the Steel industry. In Dominion Coal there has been but little doing.

There is a strong undertone to all markets just now, and the indications are that this year will see speculation again turned to mining stocks, and that the industrials will participate in the improved trade of the country.

The following are the latest quotations:—

Par value of shares.		Asked.	Bid.
.10	Canadian Gold Fields Syndicate.	.05½	.05
1.00	Centre Star	.35½	.34½
1.00	Deer Trail Consolidated	.01½	—
1.00	Giant	.03½	—
10.00	Granby Consolidated	.10½	.10¼
10.00	Montreal and Boston	—	—
1.00	North Star	.00	.04½
1.00	Payne	—	.02
1.00	Rambler Cariboo	.40	.15
1.00	Republic	—	—
1.00	St. Eugene	.50	.49
1.00	White Bear	.04	.00
100.00	Nova Scotia Steel (common)	.68	.66
100.00	Nova Scotia Steel (preferred)	122.00	118.00
100.00	Dominion Coal (common)	78.00	76.00
100.00	Dominion Coal (preferred)	123.00	121.00
100.00	Dominion Iron and Steel (ocm.)	27.00	26.50
100.00	Dominion Iron and Steel (pfd.)	76.00	74.00
——	Dominion Iron and Steel (bonds)	84.00	82.50

INDUSTRIAL NOTES.

We have received from the B. Greening Wire Company a handsome calendar for the new year. The firm writes as follows:—"Since last we had the pleasure of addressing you we have issued our new catalogue—one for each department. We hope you received yours safely, but should you not have done so, or should it have become mislaid, let us know, naming the line you are particularly interested in, and we shall have pleasure in forwarding you another. Our painting tower, destroyed by fire last March, has been rebuilt with all the latest improvements we could hear of or our experience could suggest, and we are now turning out Screen Cloth in 100 ft. or 50 ft. either green or black. Kindly note 100 ft. rolls are the standard. Our Netting Mill is running full time, and we fully expect to be able to meet any demand that may be made upon us for this or Screen Cloth. We particularly request correspondence regarding any of our lines. In wishing you the compliments of the season and a prosperous 1906, we desire to thank our numerous friends and customers for past favors, and solicit a continuance of same."

Mr. C. S. Powell, general agent of the Westinghouse Electric & Mfg. Company, who has for sometime occupied offices at 11 Pine Street, New York, has removed to the offices of the Company on the 19th floor of the Trinity Building, 111 Broadway. The Westinghouse Electric & Mfg. Company, in addition to their offices in the Hanover Building at 11 Pine Street, occupy the entire 19th floor of the Trinity Building.

The Westinghouse Electric & Mfg. Company are doing a large business in equipping mines with electric locomotives, to replace the older forms of haulage, whether animal or mechanical. Electric mine haulage considered from either the points of efficiency or economy, has so many advantages, as compared to the older practice, that the time is not far distant when any other method of mine haulage will be the exception. A recent contract closed by the Westinghouse Company is one with the Newport Mining Company, who have decided to equip their mines at Ironton, Mich., with both surface and underground electric haulage. They will use electric locomotives the year around in the various levels underground for bringing the ore to the bottom of the shaft, and after the transportation season has closed will use electric locomotives on the surface for hauling ore from the top of the shaft to the various stock piles for storage, For these purposes they have ordered 6 four-ton Westinghouse mine locomotives. Electrical apparatus for the equipment of the necessary power station will also be provided by the Westinghouse Company, consisting of a 150 Kw., 250 volt generator. direct-connected to a Corliss engine of 130 r.p.m., and a three panel switchboard, besides other auxiliary apparatus.

Two 50-h.p. boilers, and compressor and other plant, have been installed at the O'Brien mine, at Cobalt.

At the Preston and Elkhorn mines, at Greenwood, B.C., electric hoists have been recently installed. These hoists were supplied by the Denver Engineering Works.

RECENT MINING AND METALLURGICAL PATENTS.

(Specially reported for the CANADIAN MINING REVIEW.)

804,053—Coke-Oven. Mathew E. Rothberg, Cleveland,Ohio.

A coking-oven having in combination a series of adjacent coking-chambers, reverting heating-flues in the side walls of the coking-chambers, a transverse stack-draft flue in the foundation at one end of said heating-flues, vertical off-gas flues connecting said stack-draft flue with said heating-flues, a transverse air-supply flue in the foundation parallel to said stack-draft flue and at the other end of said heating-flues, and combustion chambers under the ovens and having connection with said air-supply flue.

803,544—Apparatus for Refining Lead by Electrolysis. Anson G. Betts, Troy, N.Y.

The combination with a cathode, an anode and an electrolyte adapted to dissolve metal from the anode and electrodeposit the same; of a containing-vat having its inner surface formed of a metal capable of being dissolved in said electrolyte and of a potential intermediate between that of the cathode and that of the anode.

803,886—Treatment of Iron Ores, etc. Carleton Ellis, New York, N.Y.

Process for reducing iron ores which consists in treating a progressively-advancing stream of the ore with a flame of high heat intensity and in interposing between said flame and ore a flame or current of a reducing character.

803,830—Ore Concentrator. James J. Kennedy, Guthrie, Okla.

In an ore-concentrator, a sluice-box, means for delivering ore thereto at a point near its bottom, and means for supplying air to the box in a plane above that of the feed of the ore and toward the top of the box.

803,737—Furnace for Smelting Ore. Ralph Baggaley, Pittsburg, Pa.

A matte-furnace having converting-twyers near the bottom adapted to play into a clean body of molten matte, smelting-twyers above adapted to play into a floating charge, connections extending from the converting and smelting twyers and supplying thereto air under pressure, and a burner supplying heat above the smelting-twyers.

804,186—Process of Treating Ore-Slimes, etc., containing Gold, Silver, or other values. Louis J. Drabek, Turner, S.D.

A process of treating ore-slimes to obtain values therefrom, charing the slimes with a cyanid solution into a tank causing the slimes to settle and accumulate in thickness in the bottom of said tank discharging the thickened portion by its own weight and that of the overlying solution into the top of a second tank having a barren solvent solution therein, filtering off the value containing solution, allowing the heavy slimes to settle and accumulate in the bottom of said tank, discharging them into a third tank where they are washed with water, and then filtering the values from the slimes so treated.

804,412—Dumping Car. John H. Kelly, San Francisco, Cal. The combination of a truck, a car-body tilting thereon, a swinging gate closing the front end of said car-body, a cable secured at its ends to said gate and to the frame, parts carried by said frame and car-body around which the cable passes, the position of the parts being such that when the car-body is tilted the cable is relaxed to allow the gate to swing open.

804,408—Gold Separator. Frederick M. Johnson, San Francisco, Cal., assignor to Rose Gold Reclamation Company, San Francisco, Cal., a Corporation of Arizona. In a gold-separator, a box or sluice having a retaining-bottom composed of fibrous or textile material, in combination with wire screens; arranged one above the other and in contact, and forming two continuous layers, the upper layer being, alternately, such wire screen and such fibrous or textile material.

804,227—Mechanical Roasting or Desulfurizing Furnace. Henry Howard, Brookline, Mass., assignor to Merrimac Chemical Company, North Woburn, Mass., a Corporation of Massachusetts. In a furnace, a drying-chamber mounted thereon to receive and dry the material to be treated, manually-controlled means to directly introduce waste heat from the furnace into the drying-chamber and subject the contents thereof to the action of such heat, an agitating device within the chamber, and means to positively feed the dried material from the chamber into the interior of the furnace.

804,751—Roasting Furnace. August R. Meyer, Kansas City, Mo., assignor to The United Zinc and Chemical Company, Kansas City, Mo., a Corporation of New Jersey. The combination in a furnace, of a hollow shaft, a series of hollow arms extending in pairs from the opposite sides of the shaft and communicating with the latter, a rod extending centrally through the shaft, and a series of partitions extending across the shaft between its ends and centrally through the arms and supported in part by said rod.

804,466—Concentrating and Amalgamating Table. John A. Hamilton, St. Peters, South Australia, Australia. The combination with a table ,and means to freely suspend it, of a rotatable shaft, a shaft-section on the end thereof, a universal joint connecting the shaft and shaft-section, a weight connected to and eccentric to the shaft-section, and means fixed to the table and through which the shaft-section can freely move longitudinally, whereby the table is moved in elliptical paths when the shaft is rotated.

805,017—Metal Leaching process. Thomas B. Joseph, San Francisco, Cal.

A process of extracting metals such as gold, silver, copper and nickel from ores containing the same when in a suitable condition, which consists in subjecting the said ore to the leaching action of a solution containing water, sodium cyanid and ammonium carbonate, the carbonate being in excess of the cyanid, and precipitating the metals from the solution by any well-known method.

805,090—Amalgamator. Charles W. Patten, Lynn, Mass. An amalgamator comprising an elongated, mercury-containing trough, having a weir at its discharge end, one or more submerging drums at the inlet end thereof, and means for discharging a series of water-jets on to the surface of the mercury between said weir and said drums, and adjacent the latter.

804,870—Ore Distributing Car. Ralph S. Moore, Portsmouth, Ohio.

The combination of a floor made up of moveable sections, and suitable means for, successively separating the same one from the other beneath their load, from one end of said floor.

805,215—Ore Concentrator. Matthew R. Lyle, Oakland, Cal. A concentrator comprising an inclined sluice-box having elongated openings at the bottom thereof, channels presenting elevated edges at the edges of said openings, and means for rocking said box so as to advance the material contained therein progressively by gravitation toward the lower extremities of said openings.

805,289—Magnetic Separator. Harry E. Heath, Windsor, Conn., assignor to General Electric Company, a Corporation of New York.

The combination with a stationary conductor, of a plurality of pole-pieces travelling longitudinally thereof and in proximity thereto, and means for conveying the material to be treated beneath said pole-pieces.

804,936—Metallurgical Process. Willis E. Everette, Tacoma Wash.

A process which consists in first, in preparing a suitable preliminary melt and heating it to incandescence; second, in subjecting the previously-pulverized materials, which are to be treated, to the action of liquid oxygen, whereby they are reduced to an extremely-frigid condition and are caused to occlude a portion of said oxygen; third, forcing this frigid mixture into and through the incandescent melt whereby the metals in said mixture are largely freed from sulphur and phosphorus and are rapidly fused, and finally separately drawing off the metal and slag at different levels.

805,854—Magnetic Ore-Separator. Eric Hedburg, Joplin, Mo., assignor by mesne assignments, to American Reduction Company, Chicago, Ill., a Corporation of Arizona. In a compound magnetic ore-separator and in combination a vertical shaft, an upper and a lower electro-magnet mounted axially thereon, each magnet being provided with two pole-pieces which form a shell inclosing the windings, and with a non-magnetic ring having a central outwardly-extended flange upon which the contiguous edges of the pole-pieces rest whereby the latter are separated, said pole-pieces having air-passages therethrough, means for supplying a current of air to the interior of the lower magnet, and means for conducting the current of air from the lower magnet into the interior of the upper magnet.

805,577—Treatment of Ores and the like. James Nicholas, Waterloo, England.

The treatment of materials containing zinc, by mixing the pulverized materials with water, and with a chlorid, and then heating the mixture, leaching this so-treated mixture with water, and reducing the metallic compounds contained in the leached residue to a metallic state.

805,836—Method of Producing Iron. Ralph Baggaley, Pittsburg, Pa.

A process which consists in precipitating on screen material a crust of iron-and sulphur bearing impurities from furnace-fumes, removing sulphur therefrom and then smelting the residue and recovering the iron.

805,783—Electric Furnace. John S. Dorian, Niagara Falls, N.Y., assignor to Cora M. Dorian, Niagara Falls, N.Y. An electric furnace comprising a heating-chamber, a pair of electrodes arranged in the chamber, and a resistance member electrically connected said electrodes, one of said electrodes being movable lengthwise of the resistance member for varying the extent of its exposure or its heating effect.

805,555—Process for refining Copper-Nickel Matte. Noak V. Hybinette, Westfield, N.J.

A process which consists in first roasting the matte to oxides, then leaching with weak sulphuric acid; thereby extracting principally sulphate of copper, then heating with sulphuric acid at least to a temperature where hydrous sulphates do not exist, leaching with weak sulphuric acid, thereby extracting principally sulphate of copper, then heating with hydrochloric acid to a temperature enough for partial decomposition of the anhydrous chlorids, leaching with weak acid and repeating the said heating when necessary thereby obtaining a nickel oxide, suitable for refining by ordinary means.

805,835—Fluxing Copper Ores. Ralph Baggaley, Pittsburg, Pa. A method which consists in charging into a copper smelting blast-furnace metallic iron as a flux.

DOMINION OF CANADA

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-West Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location.

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner, having discovered mineral in place, may locate a claim 1,500 x 1,500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within 15 days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.

At least $100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at $1.00 an acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location.

PLACER MINING.

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square; entry fee $5, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, $10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent. collected on the output after it exceeds $10,000.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, $100 per mile for first year and $10 per mile for each subsequent year. Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be made within ten days, if the claim is within ten miles of mining recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, $10. Royalty at the rate of two and one-half per cent. on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller.

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of $2. A claim may be abandoned, and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least $2200.

A certificate that work has been done must be obtained each year; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner.

The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

PETROLEUM.

All unappropriated Dominion Lands in Manitoba, the North-West Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery, an area not exceeding 640 acres, including the oil well and such other land as may be determined will be sold to the discoverer at the rate of $1.00 an acre subject to royalty at such rate as may be specified by order-in-council.

Department of the Interior.

Ottawa, February, 1904.

W. W. CORY,

Deputy of the Minister of the Interior.

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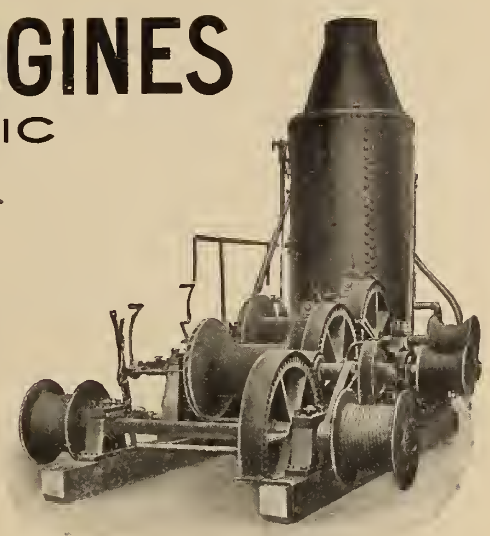

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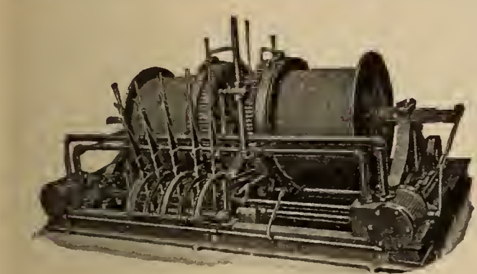

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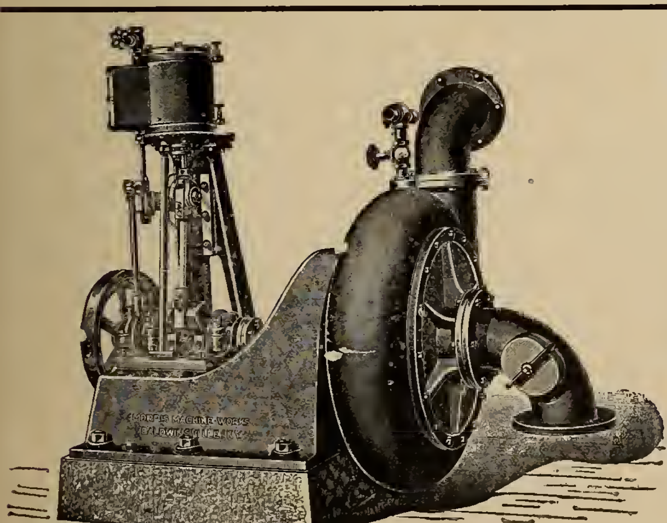

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24th YEAR OF PUBLICATION

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CONTENTS.

A correspondent writing to the *Engineering and Mining Journal* on "The Ownership of Experiences," raises a question with which every engineer at some time in his career is confronted, namely: Whether the data acquired during the course of an extensive engineering practice, or during one phase thereof, is the property of the engineer, or of the client employing him. Some courts (in the U.S.) have held that processes or inventions developed by men when in the employ of a corporation or employer are the property of that corporation or employer, but the letter referred to takes the ground, we think rightly, that data accumulated in engineering practice are the property of the engineer, and should remain so.

Our readers may remember that attempts at gold dredging on the Saskatchewan River have been, from time to time, made during the past ten years. All have been more or less directly the effort of one Dr. Roughsedge, a veterinary surgeon from Edmonton. After exhausting the willingness and resources of credulous investors in Ottawa, Montreal and other parts of Canada, this gentleman, some two years ago, turned his efforts towards the United States, and now publishes the fact that he has prevailed to the extent of being in a position to put on the river a dredge of "4000 tons" (sic.) capacity, costing $57,000.00. The ability to make a satisfactory dividend from the 10c. dirt which, according to best authorities, is about the average contents of the property, is a matter anent which Dr. Roughsedge is discretely silent.

Even in a country where journalistic enterprise is taken as a matter of course, the extraordinary useful work of our New York contemporary, the *Engineering and Mining Journal* commands attention. We would, however, specially commend the annual review number of January 6th, which contains, in a series of most readable articles, a comprehensive summary of mining operations throughout the world for the past year. The labour in getting together and compiling this information must necessarily have been stupendous. Much space, we note, has been given to reviewing our Canadian industry, Mr. E. Jacobs contributing an interesting article on British Columbia, while Mr. T. W. Gibson and Mr. Dwight E. Woodbridge write on Ontario conditions. In a degree, the enterprise displayed by our Canadian press, especially in the west, is no less commendable. Thus the exhaustive review of British Columbia mining in 1905, published in the Nelson *Daily News* on the first of the year was a quite remarkable achievement, and the same may be said of the Holiday Number of the Phœnix *Pioneer*, which is printed in magazine form, is most profusely illustrated, and contains some sixty pages devoted to a well-written description of the mineral resources and progress of the Boundary Creek district.

The Hon. J. Prevost, Minister of Colonization, Mines and Fisheries, in the Quebec Government, is contemplating a visit of inspection to the new Chibogamon district next summer in company with a qualified mining engineer, who will be specially engaged for the purpose. Mr. Prevost's object in undertaking this somewhat arduous journey is, we understand, to acquaint himself at first hand with the resources of the district and so place himself in a better position to form an opinion in regard to the steps that should be taken by the Government in assisting in the development of the region. The Province is to be congratulated in having as a Minister of Mines, a gentleman who takes so keen and personal an interest in the development of an industry, which is yet likely to occupy the first place in point of importance among the industries of Quebec. Before, however, that consummation is reached it is imperative that the present mining law should be repealed in favour of a measure that will better encourage individual effort and render difficult the present system of wholesale speculative blanketing of areas, so common. This, we believe, Mr. Prevost realizes. Meanwhile the interest that has recently been shown in the exploitation of new undeveloped mining regions is indicated by the fact that while for the fiscal year ending June 30th last, the revenue from the issuance of licenses was but approximately $3,000, already during the six months the income derivable from this source has increased to over $30,000.

The question of permitting the importation of Canadian zinc ores into the United States under the previous tariff ruling of the Treasury Department at Washington, which was distinctly advantageous to exporters, is again being raised, and a bill is about to be introduced into congress, providing that in future all zinc-bearing ores imported into the United States shall be subject to a duty of one cent per pound on the zinc contents. The definition of zinc-bearing ores, is stated as all ores, whether crude, concentrated or otherwise which contain zinc in any form or condition, either free or in combination, and in which zinc is more valuable than any other single component, irrespective of whether such ores are lead-bearing ores, or not. In discussing this bill, the *Mining Reporter*, (Denver, Col.) very truly remarks that to shut out Canadian zinc will undoubtedly cause this country to increase the production of its own metal, which will then be used, to the exclusion of over fifteen hundred tons now supplied annually by the United States. To pass the bill will temporarily benefit the producer of the ore and injure the smelter, and this period must then be followed by one of reconstruction, in which the various interests must effect a readjustment. On the whole, we question whether with improved home facilities for the treatment of zinc ores and the improved opportunities afforded for marketing the product in Europe, that the loss of the American market would be so serious to Canadian producers as at first glance might appear to be the case.

The hodge-podge of ideas respecting an economical and feasible process for obtaining satisfactory values from the silver-cobalt-nickel-arsenic ores of Temiscaming is adequately reflected in the numerous ridiculous paragraphs which are now going the rounds of the press. A majority of the producing mines are understood to have entered into a 5 years agreement with each other as to the disposition of their ores and to have decided to, themselves, solve the metallurgical problem by employing a chemist to experiment with the ores.

That, however, this combination is not entirely confident of its resources and abilities is indicated by a recent paragraph to the effect that it is also intends to ask the Ontario Government for a money grant towards defraying the cost of the proposed smelter. One wonders what has become of the offers to treat these ores which have been made by representatives of German houses, by metallurgists like Mr. Kirkgaarde, and by Lieut. Van der Osten! And one also wonders why the opulent owners of these mines desire to share their profits and knowledge with the Ontario Government?

The mines of Coleman Township are both unique and valuable; but they are not, and will not be, exempt from the conditions which govern mining and metallurgical enterprises all over the world. No one can give the seller 100% of what he buys and have any margin for profit. We trust we may be in error, but the project seems to have elements of weakness which will require both time and money to overcome. A market for silver is always available, that for nickel usually, but the market for cobalt in large quantities has yet to be created.

Dividends in the Rand (S.A.) for 1905 amounted to the very satisfactory figures of $24,250,000 (£4,849,-582). The year of 1905 was an eventful one in the history of mining in South Africa. It was marked by the production of a new record in the gold fields, the total of the Transvaal reaching the figures of between $101,000,000 and $102,000,000, an increase of over $23,000,000, while Rhodesia showed an increase of about $3,000,000. It also showed that the solution of the labor difficulty, by the introduction of coolies, was effective; whether satisfactory or not (in a political sense) seems yet to be a matter of doubt.

During 1905 several new metallurgical methods or devices were introduced into the practice of the Gold Fields, the principal of which was the fine grinding or comminution of the ore; that tube mills will be the permanent practice is very doubtful, owing to the small capacity of the machinery, requiring a large number to deal with the huge quantity of material. The year was also noteworthy from the fact that it signalized the recognition of the economy of consolidation of properties, and many independent properties were benefitted thereby. There were slight reductions on milling costs, but no sensible diminishing of mining costs.

The reduction of milling costs has led to a generally lower grade of ore being milled at a profit; this result is not only due to reductions in the cost of the various parts of milling and cyanide practice but also to the large tonnage treated per stamp head.

Finally, the year was marked by what is called the beginning of the "base metal" industry, i.e., the opening and development of tin mining in Vlaklaagtz, and Enkeldoorn, and of copper mines in the northern Transvaal.

A correspondent writes: "I have been looking into the laws of the different Provinces in Canada, with respect to Mine Managers' Certificates, and I find, in general, that no Province has any provision for shortening the time of underground experience in favor of men educated in mining schools. It is of course necessary for the mine manager to have considerable underground experience before he is given even a second-class certificate, and still more before he is given a first-class certificate, authorizing him to have full charge of a mine. It is, however, perfectly obvious to any one that educated men, and particularly men educated in mining, can secure the necessary experience and information in a far less time than men with little or no schooling, and the law governing certificates should take account of this fact. As matters now stand, the law virtually discriminates against educated men in collieries, because the time spent at mining schools counts for nothing on the certificate, while even unintelligent labor is given full value. It seems to me that the British act (Coal Mines Regulation, 1887, Amendment 1903), is reasonable. It requires 5 years undergruond work for ordinary men but exempts graduates of special classes of mining schools, from 2 of the 5 years work."

Our correspondent's contention is, we think, well taken, in view, especially of the fact that graduates from mining schools in this country at least, frequently have spent a portion of their time while studying for their degree in acquiring practical experience. It should therefore be only necessary to call the attention of the proper authorities to the alleged injustice in order to have the matter set right.

———

We are indebted to the Editor of the *Mining and Scientific Press* for an advance proof of a leading article shortly to be published discussing the California State Mining Bureau, in which the delay in appointing a State Mineralogist, attributable to political intrigue, is compared with the present anomalous condition of affairs in connection with the Canadian Geological Survey. Our contemporary remarks that when "Dr. George M. Dawson died, Dr. Robert Bell succeeded temporarily to the duties of director. This happened five years ago, but Dr. Bell remains 'acting director.' A grave injustice has been done to him and to the Survey. The energies of the chief and of his subordinates have been weakened by the cliques formed to support one or other candidate for the position, the actual director has had his authority undermined by the uncertainty of his tenure of office and the Survey as a body has lacked the solidarity belonging to an organization having its properly appointed head. In other words, it is a mistake, either at Ottawa or at Sacramento, to sacrifice work of great usefulness to the exigencies of a political lobby." While this reference is not strictly accurate in point of fact, and therefore the parallel drawn is scarcely allowable, still it is undoubtedly true that neither Dr. Bell nor the Survey has been justly treated by the delay on the part of the authorities in appointing a successor to Dr. Dawson as director of the department. Dr. Bell was either competent to undertake the duties or he was not. If he was, why has he had the responsibility without the honour and the salary to which as director he would have been entitled; if he was not a fit person, why has he been permitted to administer the affairs of the department for five years? We still maintain that there is need for re-organization and reform in the manner in which the Survey has been conducted in the past, and this may quite well be said without in any sense reflecting on the useful character of much of the work that has been done in recent years. We have therefore made no secret of our opinion that the task of re-organization, when it is commenced, should be entrusted to a young and energetic man, having special executive and administrative qualifications. But that view may be held without prejudicing one's sense of common fairness. Dr. Bell has grown old in the public service and his long record is one of which he has every reason to be proud. It is but just that his claims should be regarded, and this surely might be done without injury to the public interests.

———

The Tariff Commission which has been collecting evidence throughout the Dominion during the last few months with a view to possible tariff changes held a session at Sydney, C.B. on Friday, the 12th of January. It had been expected, in view of the somewhat strenuous and rabid utterances of members of the "Free Coal League" and its Halifax organ, that the session would have been largely attended, and that views of a widely divergent nature would have been expressed, but as a matter of fact little interest was actually shown. The Dominion Coal Co., through its chief sales agent, Mr. Alex Dick, and the Nova Scotia Steel & Coal Co. Ltd., through Mr. Harvey Graham, were the only coal companies to present an argument. Mr. John Moffat, the Secy. of the Provincial Workingmen's Association appeared on behalf of the coal miners of the Province, but it is noteworthy that none of the Pictou or Cumberland county mines thought it desirable to be represented. The argument for the maintenance of the present import duty was presented by Mr. Harvey Graham, who gave, briefly, a resumé of the coal production of N.S. for 1904, from which it appears that the total output for the year was 5,247,135 tons, of which 4,544,609 tons were marketed, and 702,526 tons were consumed by the collieries and workmen. The total number of persons employed was 11,650; the total royalty paid to the Nova Scotia Government was $515,543.00. Of the total sales nearly one half (or 1,731,000 tons) were made to customers in the Province of Quebec. Competition with both American and English coal had been keen at all St. Lawrence River ports; and it was pointed out that if this market was lost through removal of the import duty the present production would be cut in half, with corresponding distress to the coal towns in Nova Scotia.

Perhaps the most significant portion of Mr. Grahams' remarks was the statement that the efforts to find a foreign market in Europe, South America and the West Indies had been a failure with the exception of a partial success in Scandinavia. A strong case was also made out against the removal of the duty on anthracite culm or dust, which, in Ontario and western Quebec, is now being quite largely used for steam purposes.

Mr. Dick made the point that it would be difficult, or impossible, to check imports of coal intended exclusively for use in the manufacture of coke; that such coal could, and would be, also used for generating steam or power; that it would be impossible to prevent the distribution of coal, once it was imported free of duty.

Mr. Moffat confined himself to the reading of a resolution of his Grand Council, in which the P.W.A. put itself on record as opposed to any alteration of the duty on soft coal, and is in favour of establishing a duty against the importation of anthracite dust. It would seem, meanwhile, that the present duties will, in all probability, remain in force.

It is satisfactory to learn that a very interesting programme has been prepared for the annual meeting of the Canadian Mining Institute next month. In all, some forty papers have been promised, many of which, dealing as they do with recent important mining and metallurgical developments in Canada, have a special value on this account. Thus, in addition to a lecture to be delivered by Mr. J. E. Hardman on the new Chibogamon region, Mr. A. P. Low, of the Geological Survey, Mr. J. Obalski, Inspector of Mines for the Province of Quebec, and Mr. Armand Muscovici, are contributing papers on the mineral resources of this new and promising area. Prof. W. G. Miller, Provincial Geologist of Ontario has kindly consented to lecture on Cobalt, while another new quarry district, that of Windy Arm, in the Yukon, will be described by Mr. R. G. McConnell. Among the contributions on metallurgical matters, may be mentioned an interesting account by Mr. R. R. Hedley, manager of the Hall Mining and Smelting Company's smelter at Nelson, of a new matte separator recently installed and now in successful use at these works; notes on stamp mill practice by Mr. Courtenay De Kalb; a paper by Mr. J. W. Evans, on some experiments in electric smelting of titaniferous iron ores of Hastings County, Ont.; and a contribution by Mr. H. E. T. Houltain of the Canada Corundum Company, on "Some phases of Concentration". The subject matter of this paper, we understand, refers to the method of operation as being greater than the importance of special design, which is the keynote of the present direction of progress in the west. Of late some interesting developments have taken place in connection with iron mining at Torbrook, N.S., and these will be described in a paper to be contributed by Mr. W. R. Parsons, manager of the Londonderry company; and, in view of the attention that is now being directed to the exploitation of British Columbia's iron resources, Mr. W. Blakemore's paper, on the possibility of steel manufacture in that Province should be most timely. Two papers, having for their text, the need for the revision of mining law in, respectively, Ontario and the Yukon are being prepared by Mr. J. M. Clark, K. C. of Toronto and Mr. J. B. Tyrrell, of Dawson. The Secretary, Mr. H. Mortimer Lamb, in his paper, calls attention to the present necessity for the establishment of a Federal Department of mines, in the hope that the Institute, if his views are endorsed, will take official action in bringing to the notice of the Government the claims of the mining industry for recognition in this regard. Altogether the meeting promises to be a most successful one, and it is to be hoped that a large attendance may be depended on.

THE TARIFF COMMISSION AND THE IRON INDUSTRY.

One of the most important, and, to the mining industry, the most interesting of the sessions of the Tariff Commission was held the last week in January in different towns in Nova Scotia,. The interesting and important part of the sessions was the fact that they related to the continuance of the present duties on coal and iron, a majority of the producers asking that the duty, (or its equivalent the bounty) on iron, both in the metallic state and in ores, should be increased. As the matter, perhaps, is one of special importance to a large number of our readers, we summarize the essential parts of the various arguments.

The plea for assistance to the iron ore producer as distinct from the assistance given to the iron master was presented to the Commission in the form of a pamphlet containing the list of the various arguments previously printed in the *Halifax Morning Chronicle*, and this plea was supported by a verbal address by Prof. J. E. Woodman, of Dalhousie College, Nova Scotia, who claimed to speak on behalf of a special committee of the Mining Society of Nova Scotia. The *Chronicle's* plea was as follows:—That, whatever the intentions of the promoters of the iron and steel industries of Nova Scotia have been, the public of the province expected that the large deposits of iron ore in that province would be developed and utilized to the benefit of the province at large; that expectation had not been realized by reason of the fact that the metallurgical plants drew the larger portion of their ore supplies from foreign sources; this importation of cheap foreign ores suffocated the feeble iron mining industry of the province. The point was made that the various iron and steel plants of the province did not consume 5,000 tons of native Nova Scotian iron ore in the course of a year; that the output of iron ore had dropped from 75,000 tons in 1892 to 12,000 tons in 1903; that but for the exception of the consumption of native ore utilized by the Londonderry Iron & Mining Company, the iron mining industry of Nova Scotia would be practically extinct; that the remedy for this was not the imposition of a duty on foreign ores, but the taxing of the public to place a bounty on *all native ore* produced; that this bounty should be paid directly to the iron *miner*; that the iron master is adequately protected; that the iron miner has no protection. The amount asked for was the sum of 50 cents a ton on ore having 50% of metallic iron.

The argument of the *Chronicle* is to the effect that, the introduction of Newfoundland ore in place of Nova Scotia ore was not due to the lack of excellence in the native ore, but solely to the selfishness of the Nova Scotia Steel and Coal Co., who, as the owner of the large deposits at Bell Isle, went into business as miners of ore for foreign markets and were able to supply the Ferrona and Sydney furnaces with cheaper iron ore than the Nova Scotia mines could give. A table which we extract shows the rapid growth of the iron ore trade from the Bell Isle mines and the very erratic production from the Mainland mines of Nova Scotia:

PRODUCTION OF IRON ORE.

(Tons, 2,240 lbs.)

Year	In Nova Scotia Tons	In Newf'dland Tons
1894 (7)	83,512	(nil)
1895	79,636	(8) 750
1896	65,932	38,450
1897	44,146	*58,940
1898	31,050	*102,000
1899	16,169	*306,880
1900	15,507	*317,216
1901	15,200	738,206
1902	15,214	728,721
1903	11,952	588,795
1904	49,619	589,739

*At the Bell Island Mines of Nova Scotia Steel Co. and Dominion Iron and Steel Co.

In the argument several interesting facts appear which may be worth noting. The chief of these is; that in 1904 the steel companies of Nova Scotia received in national bounties sums amounting to $600,000.00; that the pay-rolls for the mines on Bell Isle amount to about $300,000.00 per annum; the admission that foreign iron ores cannot be taxed at present for the reason that too great a storm would be created by the iron smelting companies now in existence; and therefore, that the most feasible method of robbing the people for the benefit of the iron industry, is to pay a bounty to the iron miner on every ton of ore smelted by a Dominion iron works.

Prof. Woodman, in his address supporting the claims of the *Chronicle's* pamphlet, illuminated the situation somewhat by acknowledging that the development of the iron ore production of Nova Scotia was hindered by two difficulties, the first one being that the ore bodies themselves were too scattered, or not sufficiently concentrated, to make economic mining possible; and secondly, that the value of the iron ores of Nova Scotia was less than that of the ores of the Lake Superior region, or other ore, sthat were imported by the smelting companies, qualifying this statement by an opinion of his own, that this second reason was not equivalent to saying that their values would not make them non-useful by the iron master. In other words, his plea was for the use of an inferior ore by the iron master. Such inferiority, one can imagine, is proposed to be met by the Government bounty on the ore mined, the gist of the arguments, both by the *Chronicle* and Prof. Woodman, being that, if an individual owned iron ore land, it should pay the Government to give such individual such assistance in shape of bounty that he could afford to sell his ore to a smelter at a sufficiently low price to enable the smelter to use it profitably in competition with better ores obtained from a foreign source. The statement which has been current for two or three years in the Eastern press, and which is backed up by the men who know best what they are talking about—such as Mr. Graham Fraser and Mr. Thos. Cantley—namely, that the search for iron ores in Nova Scotia has revealed no bodies which were worth utilizing economically, is repeated by the Professor, and, of course, is erroneous when considering the extremely valuable metallurgical work and practice which has been initiated and is now being carried on successfully by the Londonderry Iron & Mining Company at Torbrook and East mountain ores. In reply to questions by the Hon. The Minister of Finance, Professor Woodman admitted that the benefit of the bounty on pig iron was felt by the iron miner, but only indirectly. When it was suggested that the Government of Nova Scotia should follow the practice of the Ontario Government and give a bounty out of the local treasury, his reply was, that the Province was appealing for *federal* assistance, and not for *provincial*, and the gist of the whole argument was clearly apprehended by the Hon. Mr. Fielding in his statement that any bounty granted upon iron *ore* would have to be sufficient to make the iron master take the native ore in preference to the imported ore from Newfoundland.

At the Truro session, on January 27th, a logical plea for an increase of the duty on imported pig iron and for the continuance of the bounty on pig iron manufactured from native ores in Canada, was made by Mr. Thos. J. Drummond, President of the Londonderry Iron & Mining Company. Mr. Drummond showed that prior to 1897 the duty on imported pig iron was $4.00 per ton; that by subsequent legislation it had been first reduced to $2.50, which, by the British preference of 33⅓%, had been further reduced to $1.67. The bounty on pig iron previous to 1897 had been $2.00 per ton, so that in the years prior to '97 the duty and the bounty together gave aid to the industry to the extent of $6.00 per ton. Subsequent to 1897 the bounty was increased to $3.00 per ton for one year, the bounty for subsequent years to be on a diminishing scale, so that all bounty would be removed by the end of the 10th year leaving only the import duty of $1.67 on pig iron. Mr. Drummond asked that a bounty of $2.00 per ton should be paid for a period of 5 years, and that the duty on imported pig iron should be increased to such an extent, as to give protection equivalent to $2.50 per ton, regardless of preference duties, so that for the next 5 years the industry might be sure of a total encouragement of $4.50 per net ton. Mr. Drummond made clear one point in favour of the Ontario furnaces, by showing that foreign pig could be brought to the ports of the Maritime provinces at rates which would enable it to compete very strongly witn the products of the Nova Scotia furnaces, but that when such imported pig iron had also to pay rail freights, in addition to the water freights, the price for such iron was materially increased, and hence it caused less competition with the iron produced by the furnaces in Ontario.

Mr. B. F. Pearson, speaking on the subject of "Aid to the iron industry" generally, made a plea for greater consideration to the proposal to give a bounty to makers of iron from native ore, native fuel and native fluxes. Mr. Pearson estimated that, of the cost of mining and smelting iron ore into pig iron, fully 90% was spent for labour (we very strongly question this); that in the further conversion of the pig into billets the cost was about $5.00 per ton, of which only 25% was labour; that the further conversion into rods cost about $5.00 per ton more, of which also not more than 25% was labour. He said that, in producing pig iron $10.00 to $12.00 per ton was paid for labour, (we are sure that in this respect Mr. Pearson is very much at sea). He further stated that in all but two counties in the Province of Nova Scotia there were large deposits of ore, and in the very next paragraph modified his statement by saying that, although these deposits of ore were known to be numerous and of high quality, yet *their extent was unknown*, and after paying a deserved tribute to the work of the last two or three years at Londonderry and Torbrook, spoke of other deposits concerning which all the information which we have is detrimental rather than advantageous.

THE U.S. GEOLOGICAL SURVEY AND THE STATE MINING BUREAUS.

In the course of an interesting address delivered at the meeting last November of the American Mining Congress, Dr. C. D. Walcott, director of the U.S. Geological Survey, after stating that the national organization was ready to co-operate, and was, in fact, already co-operating with the State Mining Bureaus, proceeded as follows:—

"Co-operation in the collection of statistics of mineral production is now in force, and has been carried on for several years between the United States Geological Survey and the state surveys of Iowa, Maryland and North Carolina, and arrangements are now being made with the State Geological Survey of Illinois for similar co-operation. The state geologists in these states act as agents of the United States Geological Survey. This office furnishes the stationery and the franking privilege to the agents in these states for the purpose of collecting returns, principally from delinquent mineral producers the general plan providing that the first request for mineral statistics shall be sent out direct from the Washington office, and that the state geological surveys shall endeavor to procure returns from all those not responding to the first request.

"The survey is engaged in co-operative work in geology with the states of Maine, New Jersey, Alabama, Pennsylvania and Washington. The form of co-operation varies widely. In some states, as Maine and Pennsylvania, an appropriation is made by the state and placed in the hands of commissioners, who are authorized to arrange for co-operation with the federal survey. An amount equal to the state appropriation is allotted by the federal survey and the work is done entirely by the latter organization. By this form of co-operation the funds available for expenditure on geologic work within the state are doubled and the representative of the state indicates the order in which various geological problems in the various parts of the state shall be investigated.

"A commoner form of co-operation is that in which the federal survey and the state survey each carries out certain lines of investigation, and each furnishes to the other organization the results obtained. This form of co-operation prevents a duplication of work by state and federal organizations and secures harmonious results. It also supplements the state surveys by furnishing them the service of specialists who could not otherwise be secured.

"This survey has made no active effort to induce state organizations to enter into co-operative arrangements. On all proper occasions, however, it announces its willingness to consider any form of co-operation with the state organizations which may be appropriate for the particular conditions present in each case.

"Co-operation in topographic work is now carried on with California, Illinois, Kentucky, Maine, Maryland, Michigan, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania and West Virginia. The appropriations made by the state for co-operative surveys in topography are chiefly used for actual field work, in which are included the salaries of temporary employees, who are usually residents of the state, and for the living and travelling expenses of the field force. It may be used for paying office salaries only so far as it is necessary to equalize the expenses of both parties to the co-operation.

"The methods pursued for co-operation in hydrographic investigations are essentially those followed in topographic mapping. The funds furnished by the state are supplemented by an equal amount allotted from the appropriation for gauging streams and determining the water supply of the country. The field work is carried on under a general system which has resulted from an experience extending over many years. The engineers or hydrographers are especially trained for this work, and have charge of the field work, the details of which are entrusted as far as practicable, to local men.

"From the experience gained, certain conditions essential to the success of co-operation have been established. All work which is, in part, paid for by the Federal survey and which may be published by it, or on its authority, must be controlled by the director. He selects assistants to perform such work, or approves their selection. In its execution the work is subject to the supervision and approval of the appropriate chief of the Federal survey. Payments for continuous service on account of state co-operation can, under the civil service rules, be made to a state official only in case he also receives a Federal appointment. Each year plans and estimates for the season are mutually prepared and a report of operations and results is submitted to the state officials, as is customary in the United States Survey. All agreements for co-operation are drawn in such a manner as not to conflict with the organic law of the survey in regard to collection, furnishing information or giving expert testimony.

"One important point to be considered in all such work is that the general plans and methods of the Federal survey cannot be set aside on account of state co-operation. At the present time the funds available for co-operation are so limited that its further extension is dependent upon an increase of appropriations by congress. It is against the policy of the survey to stop work on important areas or subjects in order that co-operation with individual states may be extended. The director is willing to enter into a co-operation agreement only when the interests of the country as a whole will be benefited. In the execution of the work, certain features must necessarily be taken up first, and if this order is in line with what the state desires, co-operation may be had to the greatest advantage, both to the state and to the Federal government. The general policy and work of the survey can be changed only by the direction of congress."

It seems to us that the above is suggestive of what might also be accomplished in Canada.

THE NEED OF A FEDERAL DEPARTMENT OF MINES.

The time was probably never so opportune as at present for the establishment at Ottawa of a Federal Department of Mines, under the direction of a responsible Minister of the Crown. The industry is now on the eve of great developments, and, in the next few years, under anything like favourable conditions, there should take place a quite unparalleled progress and growth in Canadian mining. Again, an industry whose annual production is already valued at over seventy million dollars, and which is therefore a considerable factor in contributing towards the general prosperity of the Dominion is surely entitled to that recognition and assistance which the creation of a distinct Department of Mines might be expected to afford. It has, we believe, been urged that the Dominion Government would scarcely be justified in establishing a Mines Department, since it could exercise no jurisdiction or control over the mines in the provinces. But that argument appears singularly ineffective, when attention is called to the useful work for years successfully carried on, under precisely similar conditions, that is so far as these limitations are concerned, by the Department of Agriculture. It is asked for the mining industry that it be aided and encouraged on just such lines. If, for example, Government experimental farms are justified, and no one will question it, there then should be equally good reasons for the establishment of well-equipped government metallurgical laboratories, where exhaustive experiments and tests might be conducted as occasion demanded. The need for such experimental works was indicated only recently, when, in connection with the Government zinc investigations in British Columbia, ore selected for concentration tests, was sent out of the country to Colorado for treatment. Obviously it would be an advantage if all such work in future could be undertaken at home under direct Government supervision. Furthermore, in a case such as Rossland district furnishes, where already large sums have been spent in the endeavour to discover a cheap and efficient method of treating the lower grade ores; or, another instance, that of the refractory Cobalt ores, Government assistance might well be sought and be productive of the most important results.

In addition, of course, to the several experimental farms, the work of the Department of Agriculture embraces a very wide range. Not only is every farmer, every small settler even, in the Dominion, kept well supplied with literature of a practical nature, including special reports and bulletins, but there are free distributions of plants and seeds; and specialists are employed to tour the country to actually teach the farmer his business. These are but instances of the valuable character of a work that is doubtless in no small degree responsible for the prosperity now so general throughout rural Canada. In very like manner the mining industry might be helped forward. What is now chiefly desired is the dissemination of practical information, that will advantage alike the miner, the prospector and the investor; and such information should, of course, be absolutely dependable and accurate. The mineral resources of the country also require to be more extensively advertised abroad and attention called to such progress as is being made. This might best be accomplished by the publication of statistics at regular and at more frequent intervals than at present; while even the very up-to-date methods of the U.S. Geological Survey of issuing and judicioulv circulating a weekly bulletin summarizing the work of the department for these periods, might ultimately be adopted. It is not, however, the purpose of this article to go at length into details, but merely to point out that there is ample scope and work—which, in fact, might be extended indefinitely —for a Federal Department of Mines.

THE CENTRE STAR AMALGAMATION.

At a meeting of the shareholders of the Centre Star Mining Company, held on January 27th at Toronto, the plan as proposed by the directors for the consolidation of the properties of this company, the St. Eugene Mining Company, the Trail Smelter and the Rossland Power Company, was duly approved. Under this arrangement the capitalization of the consolidated property has been placed at $5,500,000.00, of which, shares to the equivalent of $4,698,800.00 will be issued to shareholders, in exchange for their present holdings, on the basis agreed, while $801,200.00 will be reserved for treasury uses. The respective companies are also contributing $600,000.00 pro rata to provide working capital. Previous to the meeting the directors issued the following circular:—

Your directors have for some time past been of the opinion that a consolidation of the properties of the Centre Star Mining Company (including those of the War Eagle Mining Company), the St. Eugene Mining Company, the Trail smelter and the Rossland Power Company, was desirable and in the interest of the shareholders of your company, and to that end caused an examination of the various properties to be made, and reports thereon to be prepared by Professor R. W. Brock, of the Dominion Geological Survey; John H. McKenzie, formerly general manager of the Le Roi mines, and a member of the firm of Bradley & McKenzie, mining engineers of San Francisco; James Cronin, general manager of the Centre Star, War Eagle and St. Eugene mines; R. H. Stewart, E.M. superintendent of the Centre Star and War Eagle, and J. M. Turnbull, E.M.

Your directors in pursuance of the general scheme for amalgamation of the properties above mentioned, have, as you have already been advised, entered into an agreement providing for the sale of the entire assets of your company to the Canadian Consolidated Mines, Limited, in consideration of the issue of 15,555 shares (of the par value of $100 each) of the capital stock of the last named company the consideration for the sale being based upon the report of the experts named above.

The capitalization of the Canadian Consolidated Mines, Limited, will be $5,500,000, of which the sum of $4,698,800 stock will be issued in consideration of the purchase of the entire assets of the following companies, in the following proportion, that is to say:

The St. Eugene Consolidated Mining Co., Ltd	$2,333,300
Centre Star Mining Co., including War Eagle properties	1,555,500
Trail smelter	750,000
Rossland Power Company	60,000
Total	$4,698,800

The remaining $801,200 will be for the present retained in the treasury.

Your directors consider it absolutely necessary that the new company should commence business with the full complement of supplies and with not less than, approximately, $600,000 in cash as working capital, and accordingly have arranged that this amount should be contributed by this company, the St. Eugene company and the Trail smelter in proportion to the relative values fixed by them for the purpose of amalgamation, the working capital so contributed being included in the values above stated.

Your directors are of the opinion that the amalgamation is very greatly in the interests of the shareholders of all the companies, as affording greater security for the payment of dividends, both in relation to a consistent or average production of ore and as giving to the amalgamated company a self-contained business not dependent upon its ability to make satisfactory contracts with independent smelters.

THE COPPER SITUATION.

The National Conduit & Cable Company reports copper as remarkably steady and strong at about the level of 18¾c. for electrolytic wire bars for delivery from three to six months hence

The danger of any decided reaction this side of June or July has been reduced to a minimum by aggressive buying on the part of some large consumers and running through to July. An era of high prices has been established and conditions have swung around in favor of keeping business up to the new level of prices.

The production has increased considerably over previous years. It is probable the United States copper production last year was not far from 395,000 to 400,000 tons, as against 362,739 tons, or an increase of about 10%, which is only about normal for the domestic output. Consumption for 1905 in this country is estimated at between 600,000,000 and 650,000,000 pounds. The year 1906 began with a scarcity of available copper, and the question of ready stocks is less of a factor than in many years. The trade reports from London are of an encouraging nature. Stocks of copper in Europe are small and with a strong statistical position there is no chance for the market to be other than firm.

THE CALCITE VEIN--A TALE OF COBALT.

By Dr. W. H. Drummond.

I used to be leevin' on Bonami,
Fines' place on de lake, you bet!
An' dough I go off only wance, sapree!
I t'ink I will leev' dere yet,
Wit' tree growin' down to de water side,
W'ere leetle bird dance an' sing—
Only come an' see you don't shout wit' me,
Hooraw! for Temiskaming!

But silver boom an' de cobalt bloom
Play de devil wit' Bonami,
So off on de wood we all mus' go,
Leevin' de familee—
Shovel an' pick, hammer an' drill,
We carry dem ev'ry w'ere,
For workin' away all night an' day
Till it's tam to be millionaire.

So it aint very long w'en I mak' de strike,
W'at dey're callin' the vein cal-cite,
Quarter an inch, jus' a leetle " pinch "
But soon she is come all right
An' widen out beeg : mebbe wan sixteen
An' now we have got her sure!
So we jomp on our hat, w'en she go lak' dat,
Me an' Bateese Couture!

Early in spring we see dat vein,
W'en de pat-ridge begin to drum,
De leaf on de bush start in wit' a rush,
An' de skeeter commence to come——
Very nice tam on de wood for sure,
If you want to be goin' die,
Skeeter at night till it's come daylight,
An' affer dat, small black fly!

Couple o' gang lak dat ma frien',
'Specially near de swamp
An' hongry too, dey can bite an' chew
An' kip you upon de jomp—
But never you min', only work away
So long as de vein is dere—
For a t'ing so small don't count at all,
If you want to be millionaire.

"An' dis is de price, " Bateese he say,
"T'ree million or not'ing at all!"
An' I say "you're crazy, it's five you mean
An' more, if you wait till fall!
An' s'pose de silver was come along
An' cobalt she bloom an' bloom,
We look very sick if we sole too quick
An' ev'ry t'ing's on de boom."

De cash we refuse w'en dey hear de news,
W'en I t'ink of dat cash to-day,
I feel lak a mouse on a great beeg house
W'en de familee move away.
One million, two million, no use to us—
Me an' Bateese Couture,
So we work away ev'ry night an' day
De sam; we was alway poor.

An' den wan morning a stranger man,
A man wit' hees hair all w'ite,
Look very wise, an' he's moche surprise
W'en he's seein' dat vein cal-cite——
An' he say, "Ma frien', for de good advice
I hope you'll mak' some room——
From sweetheart girl to de wide, wide worl'
Ketch ev'ry t'ing on de bloom!

Kip your eye on de vein' for dere's many a slip
Till you drink of de silver cup,
An' if you're not goin' to go 'way down—
You're goin' to go 'way, 'way up."

"Now w'at does he mean," Bateese he say,
Affer de ole man lef',
"Mebbe want to buy, but he t'ink it's high
So we'll finish de job ourse'f,
Purty quick too," an' den hooraw.
We form it de compagnie,
An' to geev dem a sight on de vein cal-cite
We work it on Bonami.

Can't count de money dat's comin' in,
Sam' as de lotterie,
Ev'ry wan try, till bimeby
Dere's not many dollar on Bonami.
An' de gang we put onto de job right off,
Nearly twenty beside de cook,
Hammer an' drill till dey're nearly kill,
An' feller to watch de book.

Too many man, an' I see it now,
An' I'm sorry 'cos I'm de boss,
For walkin' aroun' all over de groun'
Dat's reason de vein get los'——
Easy enough wit' de lantern too,
Seein' dat vein las' night,
But to-day I'm out, lookin' all about
An' w'ere is dat vein cal-cite?

Very curious t'ing, but you can't blame me,
For I try very hard I'm sure—
Helpin' dem on till de vein is gone,
Me an' Bateese Couture,
So of course I wonder de way she go—
An' twenty cent too, a share,
An' I can't understan' dat stranger man
W'at he mean w'en he's sayin' dere

" Kip your eye on de vein for dere's many a slip
Till you drink of de silver cup,
An' if you're not goin' to go 'way down,
You're goin' to go 'way, 'way up!"

NOTE ON A NEW INSTRUMENT FOR SURVEYING DEEP BORE HOLES.

By J. B. Porter, D.Sc., M. Can.. Soc.C. E.

Read before the Mining Section, 30th November, 1905.

It is a well-known fact that deep borings are seldom true, and although artesian wells seldom depart very much from the vertical owing to the method of drilling them, yet diamond drill holes and other borings with rotary apparatus very frequently drift very far out of line. So long as the hole is not deep this drifting is not a serious matter, but on holes of say 1,000 feet, the departure from line sometimes exceeds ten per cent. In extreme cases such as certain very deep recent borings near Johannesburg, holes which were intended to be vertical have drifted more than 2,500 feet to one side of their aim.

In view of the great cost of thesedeep borings it is extremely desirable that the exact location of cores brought to the surface should be determinable, and a number of devices have been introduced within the last few years for the purpose of surveying holes. Most of these devices are comparatively crude and their use involves a great deal of labor.

The apparatus most generally used of late years has been a cylinder of glass, portially filled with hydrofluoric acid. This cylinder, usually less than one inch diameter, is inclosed in a brass case and attached to the end of a string of screwed rods and lowered into the hole to a known depth where it is left for some hours and then withdrawn. The inclination of the hole can easily be read from the glass vessel, as the upper surface of the hydrofluoric acid etches the glass quite distinctly, but the direction of the hole can only be determined by marking the orientation of the top rod while the etching is taking place, marking each joint when the rods are taken apart and finally screwing them together again on the surface in order to compare the orientation marks with the etching on the glass tube. By surveying points at distances of say 300 or even 500 feet, the general course of a bore hole can be determined by the

Trans. Can. S. C. E., Nov., 1905.

method above described, but the method is laborious and costly and owing to almost unavoidable twisting of the rods the results have seldom proved very satisfactory.

Another method of surveying involves the use of plummets and compasses immersed in a solution of gelatine which slowly hardens after the apparatus has been sent down the hole. This device, although very ingenious, has proved very difficult in use and has not met with much success, especially in deep holes. A very recent form of the apparatus uses paraffine in place of gelatine. The instrument contains an electric resistance and is connected with a dynamo on the surface by double insulated cables. The compass and plummet remain fixed in the solid paraffine while the instrument is lowered to the station in the hole. Current is then sent through the cable and the paraffine melted. The current is then shut off and after sufficient time has elapsed for the paraffine to solidify the instrument is reeled in and its records read. The apparatus should give accurate results, but the long line of insulated cable is costly and liable to injury. (Marriott—Trans. Inst. Min. and Met., Feb., 1905.)

A few months ago an instrument maker in Johannesburg designed a very ingenious apparatus containing compass, plummets, small cameras and electric light, the whole connected with a small adjustable clock so that the light could be turned on for a given period after the apparatus had been lowered into the hole. This apparatus was described by its inventor, Wm. Helme, at a meeting of the Institute of Mining Surveyors of the Transvaal on May 27th, 1905. It has since been used in surveying a number of holes and has proven extremely satisfactory.

A prominent mining engineer of the author's acquaintance states that he has had the machine tested by surveying several holes twice and has found the readings to agree so closely in all cases that he scarcely considers it necessary to take check readings unless the first set show some unusual change of direction in the hole. The apparatus, instead of requiring rods, the use of which involves a great expenditure of time and labor, and the use of a derrick and a power hoist, can be lowered on the end of a piece of flexible wire from a large reel and thus several observations per day may be taken by two men.

The writer has not had an opportunitg to use the instrument in actual surveying, but has taken a number of observations with it on the surface and has found its records interesting and apparently exact. He therefore feels justified in submitting the following brief description of the instrument taken from the original paper by its inventor.

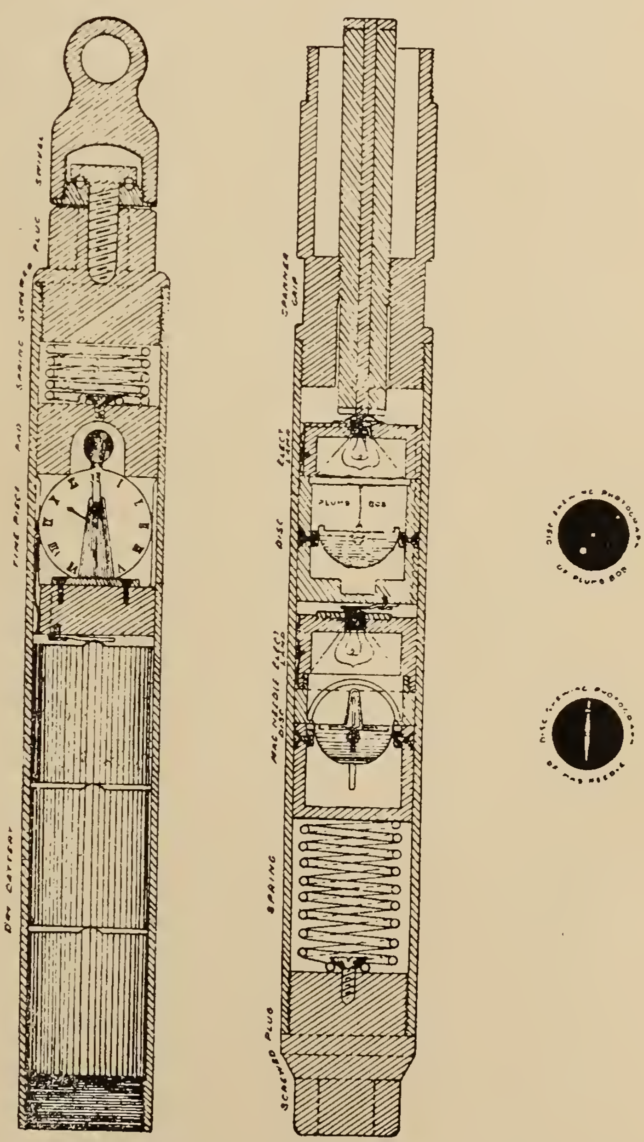
GENERAL DESCRIPTION.

Briefly described, this instrument is one in which both dip and deviation are recorded by means of photographs of the positions of both a plumb-bob and a magnetic needle at any desired point in a bore-hole. The photographs are taken by means of two small electric lamps lit by a "time contact."

DETAILED DESCRIPTION.

The instrument comprises a brass cylinder 20 to 30 inches long: both length and diameter are varied to suit the particular requirements. The cylinder is made in two portions, which screw together quite flush shoulder to shoulder. The top and bottom are closed by means of tightly-fitting screwed plugs. To the top plug is attached a brass swivel with an eye piece, by which the instrument is suspended. The swivel is fitted to the plug with ball bearings. The object of this swivel is to prevent the wire, which is used in lowering the instrument, from twisting; also, to minimise risk of the instrument kicking against the sides of the borehole when being lowered or raised. Inside the cylinder, immediately beneath the top plug, is a spring resting on a pad, which keeps firmly in position a small watch or timepiece. Below the watch is a dry battery. Below this again is arranged a tiny electric lamp, and below the lamp is a glass plate, from the centre of which hangs a small plumb-bob. Below the plumb-bob is a circular brass plate supported on gimbal bearings, so that it always remains in a horizontal position. On this plate is placed a small disc of sensitised paper.

DIAGRAM OF INSTRUMENT



Below this is another electric lamp, and below this again is a compass, which is also supported on gimbal bearings. On the dial plate of the compass is placed another disc of sensitised paper; each disc is pierced by a pin-prick in the centre, and another on one side, and both discs are fixed in exactly the same relative position, one above the other, when in the instrument. The whole is kept firmly in position from below by another spring placed under the little cup holding the magnetic needle, and resting on the bottom screwed plug. When the hand of the watch is passing the 12 o'clock point on the dial, it makes contact for about 15 seconds with a small projecting spring made of copper foil, which is connected with one line from the battery. The hand of the watch is connected with the other line; and so, when in contact with the spring, the circuit is completed; both electric lamps are lighted; and photographs are taken of the positions of the plumb-bob and the magnetic needle. It is only necessary to set the watch so that the hand will only pass the 12 o'clock point after sufficient time has elapsed to allow for the instrument being lowered to the required depth, and also to allow for the plumb-bob and magnetic needle having come to rest. In practice, it is usual to take readings at, say, every 200 feet to 300 feet, and two readings should invariably be taken in each instance. When once the photographs have been obtained, the rest of the work is easy; for the height of the point of suspension of the plumb-bob above the centre of the disc being known, and the distance of the lower end of of the plumb-bob from the centre of the disc having been obtained by accurately measuring the distance between the centre os the photograph of the plumb-bob and the centre of the disc, angle of dip can be calculated. The direction is also easily obtained by placing the two discs in the same relative positions which they occupied while in the instrument, which can at once be done by means of the two pin-pricks on each. The direction of the line joining the centre with the image of the plumb-bob on the one disc will then (unless it happens to fall in the magnetic meridian) make an angle with the photograph of the magnetic needle on the other disc, and from this angle the magnetic direction of the path of the borehole at that particular point is determined. In surveying a borehole, say 4,000 feet in length, two sets of readings should first be obtained at regular intervals, which should not exceed 250 feet in length. When these have been obtained, the dip and deviation must be calculated for each point, and then sufficient data are available to plot, in plan and section, the true path taken by the borehole. (Pro.. Institute of Mine Surveyors, Transvaal, May 27, 1905.)

THE WEST GORE ANTIMONY DEPOSITS.

By Alex. McNeil, President of the Dominion Antimony Co. Ltd.

This is written at the editor's request for information about the West Gore Antimony deposits. The number of such inquiries now coming from foreign countries shows that this property is becoming known abroad. Enough has been learned to say that Nova Scotia will in the future be an important producer of antimony and your readers may therefore be interested in the matter.

Antimony was discovered at West Gore, Hants County, Nova Scotia, twenty-five years ago. In Nova Scotia, antimony as a mineral passes to the owner of the soil. The formers who made the discovery undertook the development and operation of the mine. Making a mine and building a load of hay are two different things, but it is fair to say that the West Gore mine in those days was managed as well as many Nova Scotia gold mines have been. Several thousand tons or high grade ore were taken out and shipped and sold to Swansea smelters. The ore was sold at the time for its antimony contents. The present company believe that the ore then shipped contained between $100,000 and $200,000. in gold, about which nothing was said by seller or buyer.

A good mine with high values can stand bad management to a certain depth. In this case it went to 400 ft., and stopped. Then it became an abandoned mine for a decade. During the interval some prospecting in search of a southern vein resulted successfully and a small quantity of very good ore was taken from there.

The property was taken over from the writer by the Dominion Antimony Company, Limited, at the beginning of 1903. Since that time the old mine has been unwatered and the underground workings remodelled so that prospecting could be carried on systematically and economically. There has been no cessation of work since. The main shaft was carried down a little over 500 ft., levels were extended on the 2, 3, 4, and 500 ft. level. At 260 feet east on the 500 ft. level a winze was put down 200 feet and a level driven back toward the main shaft. About the same distance west on the 500 ft. level similar work is proceeding. The main purpose of this was to determine the advisability and correct position for a larger main shaft which will be driven vertically to intersect the vein at about 1000 feet. The vein on which this work is being done is a fissure. It is very clearly defined, especially on the 700 ft. level. Sometimes the vein narrows to a foot or two; sometimes it widens to eight or nine feet. Generally on the 700 ft. level there is an average of two to four feet of very good ore. The development work so far carried on, with a small amount of necessary stoping, has yielded about 700 tons of high grade ore and 7,000 tons of second class ore. The separation is arbitary and mechanical and made for the purpose of selling ore containing over 40% antimony. This first-class ore has averaged about 45% antimony and a little over $50. in gold per ton. The dump ore, so far as can be judged on the sampling done, contains between $20 to $30, in both metals.

The policy pursued by the company in making the mine has been a fairly conservative one. A small but effective prospecting plant housed in plain but well arranged buildings enabled the Company to put in underground development most of the eighty odd thousand dollars, that have been spent. Then the Company looked around for a good man for Manager. They found him located in Boise City, Idaho, accepted his terms with regard to salary, built the kind of house he wanted for his family, and showed that it trusted his honesty and judgment by accepting his plan of work. The result has been satisfactory.

West Gore is a pretty valley with fertile farms that can grow good apples. It also grows good young men who leave it for the United States and other parts when they grow up. Since the building of the Midland Railway one can reach this section by rail which is 2½ miles from the mine. From Clarkesville on the railway over a fairly good road, part of which has been built by the Company, one reaches nearly the highest point in the County, which, although a highland for Hants, is not more than a good sized hill. Up on this hill the Company has acquired territory until it now owns about 500 acres, covering about 1½ miles on the strike of the veins. Antimony float has been found in various directions from the mine. At Central Rawdon, five miles away, there was enough antimony in the gold ore to make profitable recovery by amalgamation impossible.

The problem of recovering both the antimony and the gold was taken up as soon as the present operations began at the mines. It is not a new question, for antimony-gold ore has been found in other places, and at various times large sums have been spent upon processes for recovery, which, for one reason or other, have turned out unprofitable. The Company working at West Gore first turned its attention to concentration. Experiments carried on upon quantities of several tons in a regular mill plant established that a good concentrate could be obtained.* Dry concentration on a smaller quantity was also successful. The necessary loss in concentration and the comparatively low values obtained in the ordinary market for the metal contents, induced the Company to carry on an elaborate series of experiments with a view to reaching direct recovery or the gold contents at the mine. The Company was encouraged in its work by the fact that in the market the price for the gold contents rose while it was at work from 50% of assay value to a basis of paying full value less $10. It may safely be said that the treatment of antimony-gold ore for the recovery of a high percentage of both metals at a moderate cost has been solved. A similar ore in France led to the problem being submitted to J. S. MacArthur of Glasgow, celebrated for his connection with the cyanide treatment. By using a weak solution of caustic soda, Mr. MacArthur found that he could put the stibnite readily and quickly in solution and by drawing the carbonic acid gas from the fires he could precipitate the antimony in a brown powder. As the gold was not affected by his process it remained in the residue. The residue was treated by calcination and cyanide and 95% of the gold recovered. When Mr. MacArthur visited the mine at West Gore he found a new problem facing him. The eastern winze had passed through a heavy body of native antimony. There is not known a similar body of native antimony in the world, although it has been found in small quantities in other parts. Its occurrence here necessitated further experimental work by Mr. MacArthur which, it is understood, has resulted successfully. After three years of investigation the Dominion Antimony Company has reached the conclusion that it can proceed to treat its own ores, and the work of doing that will be begun during the present year. The experimental work of this Company will be the subject of a special paper in the Nova Scotia Government mine report of the present year, prepared therefor by D'Arcy Weatherbe, the capable metal mine Inspector of the province. Many mining men of prominence have visited the works at West Gore, and they have all expressed their opinion as favourable to the future of the mine there.

MINING IN QUEBEC IN 1905.

(By our special commissioner.)

Mining operations in the Province of Quebec were carried on during the past year with regularity and success.

Asbestos has been in good demand, and the mines at Thetford, Black Lake and Danville have been working to full capacity, with the result that the output will be exceptionally great. New properties have also been developed at Tingwick and Wolfestown and the mica market conditions appear to have improved, and the principal mines of the Ottawa region have been steadily operated. The price for small mica is considered satisfactory, but for larger sizes conditions are not so advantageous. Several firms at Ottawa are now taking the mica produced in Quebec and Ottawa, it being split by them and then shipped to the United States. It is a matter perhaps noteworthy to state that these same firms are also handling Indian mica. Attention has recently been called to the white mica mines of the Province, on account of the rare metals, such as radium, thorium, uranium, cerium and others which are found in association with muscovite, and, it is alleged, occur in workable quantities. A company has been organized to develop several of these mines in our Laurentian range.

Phosphate is obtained in small quantities in working the amber mica mines, and is utilized chiefly at Buckingham, in competition with American phosphate.

Chrome mining and concentration is becoming a permanent industry in Coleraine, and the production is steadily increasing every year. The concentrates are high grade and regular in composition. They find a fair market in the United States, although they are brought in competition with the Caledonia ores, which are produced chiefly, and on a large scale.

The conversion of iron ore into pig has been in progress at Drummondville and Radnor. Good results attended last year, as usual, the working of the well known copper mines of Capelton, a part of the product being utilized locally in the manufacture of sulphuric acid, while the remainder was shipped to the United States. There are meanwhile rumours of the re-opening of some of the old copper properties in the district of Sherbrooke.

At Three Rivers the ochre production has been continued.

Conditions in Graphite mining continue difficult, but an improvement has taken place and this branch of the industry is likely ere long to assume much greater proportions. There is no change in the condition of Feldspar and Baryte.

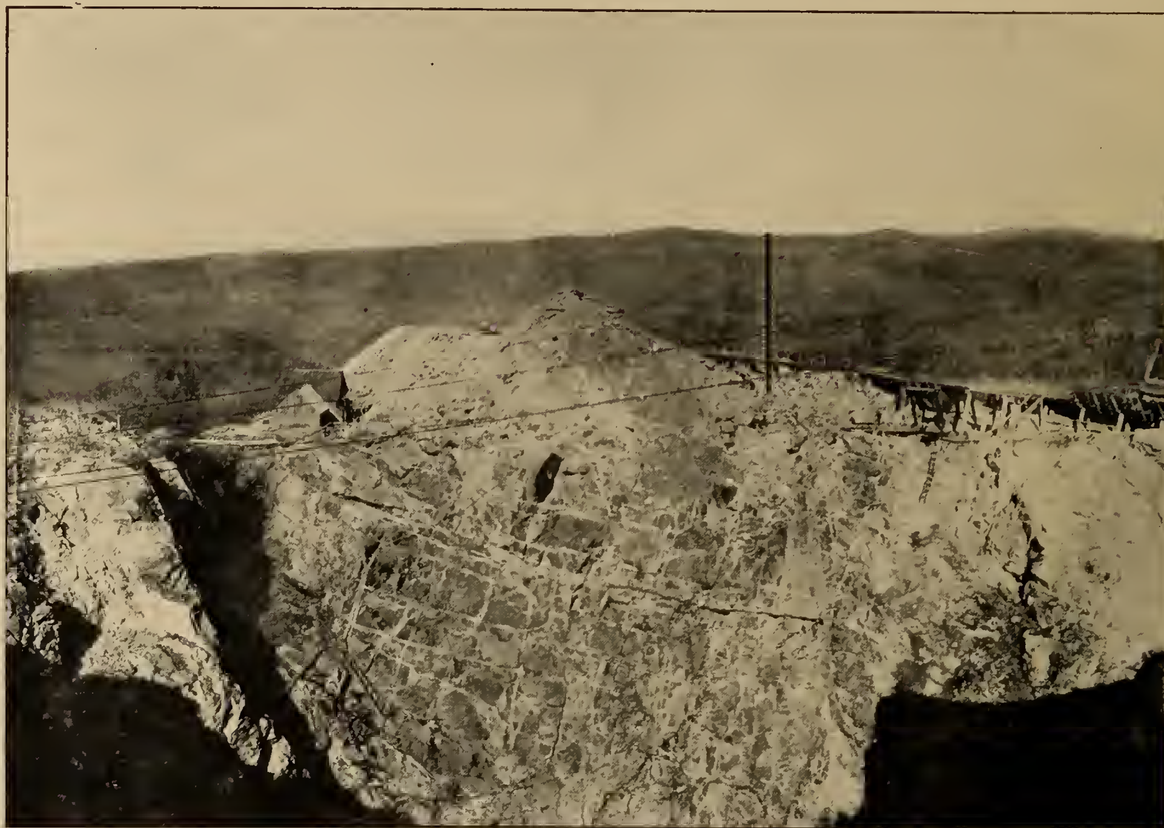
Natural gas is now being used in the Eastern Townships for domestic purposes in several of the villages near Three Rivers, while successful experiments have been carried on for the compression of peat near Farnham.

On the north shore of the St. Lawrence a large quantity of magnetic sand has been ascertained, and recent tests indicate the possibility of successful concentration and utilization of this material.

The building and ornamental stone quarries have been worked extensively, and it is also worth recording that cement works have been established at Hull, and are producing from 1500 to 1800 bbls. of material a day.

Speaking generally, the mining industry in Quebec during the year has made a steady advance, which, in the near future will be considerably accelerated. Not the least notable of the year's developments is the confirmation of the improved and promising discoveries in the Chibogamoo district, and there is every reason to believe that this region in Northern Quebec will become in due course a profitable field of mining operation.

MINING IN QUEBEC IN 1905.



Seamy Partings Containing Asbestos in The Union Mines, Black Lake.

MINING IN QUEBEC IN 1905.

THE FIBERIZING PLANT OF THE BELL'S ASBESTOS CO., THETFORD.

QUARRY OF THE BELL'S ASBESTOS CO., THETFORD--Looking West.

MINING IN QUEBEC IN 1905.

Arrangement of Cable Derricks and Tracks Near Border of Pit—King Bro's. Mine, Thetford.

New 500 Tons Asbestos Separation Plant of King Bros., Thetford.

MINING IN QUEBEC IN 1905.

New Fiberizing Plant of American Asbestos Co., Black Lake—Fiberizing Mill, etc.

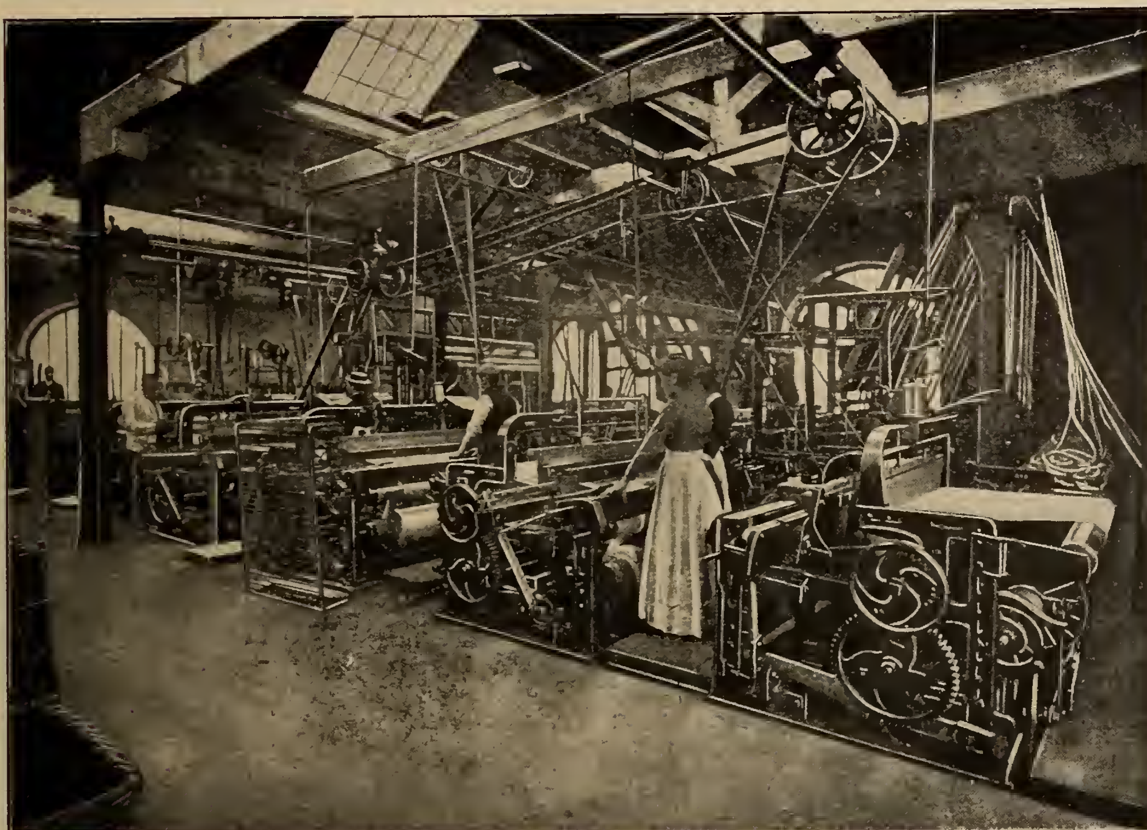
The Asbestos and Asbistic Coy's Plant, Danville.

MINING IN QUEBEC IN 1905.

The United Asbestos Co's Works—Spinning Dept.

The Plant of The Johnson's Asbestos Co., Black Lake.

MINING IN QUEBEC IN 1905.



United Asbestos Co's Works—Weaving and Braiding Department.

United Asbestos Co's Works—Weaving Department.

THE BEARING OF ENGINEERING ON MINING.
With Especial Reference to Mining Education.*

By Prof. J. B. Porter, Hon. D.Sc.

(Continued from the January Review.)

About sixty or seventy years ago civil engineering had become a sufficiently definite profession to attract the attention of the schools and many colleges and universities, both at Home and abroad, created departments of engineering. In most cases a single instructor or professor was called upon to do the work; at best the staff was meagre, and experimental apparatus of the simplest kind had to suffice; but again the day was saved by the enthusiasm of these pioneers in a new educational field. The teaching was of necessity chiefly general and theoretical, and details, when treated at all, were discussed informally. The result of this method and of this enthusiasm was that the young men went out with high heart, ready for any fate, and therefore their success was great. Of these men are the great engineers of the present day.

As engineering science developed, its practice became specialised and forty odd years ago the schools began to follow suit. Mining and metallurgy had always been considered somewhat apart, and often were the first subjects to receive special consideration. In other cases, schools originally instituted as schools of mines crystallised out successively departments of civil, mechanical, electrical engineering, etc.

This process of differentiation has gone further in the United States than elsewhere, and no less than thirteen separate and distinct engineering courses are offered with more promised for the immediate future*. Even in Canada, where we are accused of being conservative, my own University offers its bewildered matriculant six or seven formal engineering courses, and some of these again branch in the final year. These special courses are no doubt necessary, and their number will probably increase; but great harm will be done to engineering in a broad sense if this tendency to specialised teaching cannot be kept within strict bounds.

The same fundamental sciences underlie all branches; the same training in physics, mathematics, and mechanics is essential to a true understanding of each profession and the man who learns these and other basal subjects thoroughly, even at the expense of technical training, is far more likely to succeed ultimately even in any special technical work than the man who has received elaborate training in one line, but whose first principles are "weak." Furthermore, not one student in a dozen knows when he comes up to the University which branch of engineering he really prefers; still less does he know which one he will ultimately practise. Young engineers are no less subject to chance and circumstance than other men; and for this reason, even if there were no better one, we should strive first to make our men engineers, and then and then only give them special training.

The fact that no man can tell in advance what his life's work will be is sometimes used as an argument in favour of a general engineering course, with a smattering of everything. An intelligent boy who keeps his eyes open will learn not a little of many practical things in connection with his theoretical studies, and the most effective method of teaching is to point theory with practical illustration whenever this can be done without losing sight of the main issue. It is, however, a most serious mistake to make a course general rather than thorough, and even a speciality really well taught is better than broad, but shallow instruction.

The courses in mining engineering offered by the best schools, especially in the United States and Canada, are frequently criticised as having the fault I have just named: in brief of being too broad and of attempting too much. Mining engineers, in all but a few favoured localities, are usually alone so far as trained associates go, and the problems they have to face are more varied than those coming to any other engineers. General engineering work and surveying are their daily task; simple problems in electrical and mechanical engineering must be disposed of without the assistance of specialists, and a good knowledge of geology with some mineralogy and chemistry is absolutely essential. No other engineer must know so many things; and, therefore, in general, we teach our mining students more subjects than are ordinarily given in other engineering courses. It is a fair question, however, whether even electrical and mechanical engineers would not be the better for a fair knowledge of geology, and such simple chemistry as we give our candidates for mining degrees.

Mining courses are sometimes objected to by another class of critics, the so-called practical men, as being too theoretical, and by a third class as being too technical and material at the expense of theory. These criticisms neutralize one another to a large extent, but I fear that the last has occasional justification, and shall deal with it later.

Thus far, I have not touched upon a matter that is just now receiving a great deal of attention, viz., the extent to which practical and technical training should enter into an engineering education. This subject has recently been discussed by so many different learned bodies and individuals that I approach it with hesitation. It is, however, of vital importance to engineering education, and must be carefully considered.

The last word on technical education is in the form of a report or to speak more correctly, a series of questions, issued a few weeks ago by the Committee on Engineering Education of the Institution of Civil Engineers. This committee, under the chairmanship of the last president of the Institution, Sir William White, has evidently considered the subject very carefully, and has made up its mind on certain points. On others it is apparently divided, and the alternative opinions are stated briefly and impartially. The paper is now in the hands of a number of engineers and educators, who have been asked to reply to certain questions; and the committee will no doubt give due weight to their opinions when it draws up its final report.

It would be improper for me to discuss this paper at length; but I think I may state certain conclusions, with which I heartily concur, without betraying any confidence. The committee is apparently convinced (a) that engineering students in all branches should take the same course in the elementary sciences, and in certain advanced subjects; and that technical work and studies in their special branch should be deferred to the last part of the course. This point has already been sufficiently discussed.

The committee thinks that: (b) Engineering students should have some practical elementary manual training, and that this had best be regular work in shops of one or more kinds. The amount of this work, its exact nature, and whether it should precede, accompany, or follow the academic work are, however, matters on which the committee does not express a definite opinion. (c) The committee thinks that students should also have some practical technical training in works The nature and amount of this training, and whether it

*Architectural, chemical, civil, commercial, electrical, hydraulic, mechanical, metallurgical, mining, municipal, naval, railway, and sanitary engineering.

should precede, accompany, or follow the technical part of the course, are not definitely decided.

An engineering student, whatever his specialty, should undoubtedly do some shop work on the ordinary materials of construction at a very early period in his course. He will not be able to spare time enough to become a skilled workman, or even a half-skilled apprentice, and he must be made to fully understand this; but he can and should work long enough to know something of the use of tools, and to understand the qualities of the materials of construction which he is about to study theoretically. This elementary shop work is often attempted in workshops connected with the technical schools themselves, and frequently it can be done in the afternoons while regular studies are going on. This method is economical of time, and there are many advantages in having the teaching and shop work under the same direction; but unless a boy is to get thorough practical training later it is better for him to get his experience in ordinary shops, where he would be required to work full time under ordinary shop discipline. In no other way can he be made to realize what work really is; the intimate acquaintance with workmen is also very useful.

This shop work if done outside of the school can usually be arranged for the long vacation which should be long enough to give time for it, and for a reasonable holiday. Two periods of two or three months each in two successive vacations should suffice for an ordinary boy, especially as practical technical training is also required at a later period in his course. This latter technical work is even more important, in my opinion, than the shop experience. It should, if possible, follow the general science teaching, and precede the specialisation.

These students should first be taken to the mines in a body and be given an opportunity to study works under the guidance of a staff of competent instructors. After a month or six weeks of this field class work each student should obtain bona-fide employment in some works in his chosen speciality, but the exact nature of the work is of no very great moment, so long as it is good engineering work, done by good workmen intelligently directed. The important thing again is to get the student in touch with real work and real wage-earners, and to give him an idea of scale. The elementary shop work may be done if necessary at convenient times in a school workshop, but this technical work must be real in every respect. The student should, for the time being, become a pialn workman on wages, responsible to his foreman for certain duties, and liable to penalty or discharge for cause.

The time to be given to the work must depend on circumstances. Three months, under the right sort of foreman, in a small but interesting mine or works, will teach as much as a year of ill-directed drudgery. Further more, students differ greatly in the readiness with which they take to practical work. I have known men who were the better students for having had many years of hard apprenticeship; but very frequently the man who has spent even one year in practice finds it difficult to return to his classes. He is earning money at work, and can often ill-afford to give it up, and again become dependent on his people. Study also often proves irksome, and sometimes very difficult, after a man has been actively employed in work. As a result, many men fail to return to their final studies, and thus lose what should be the most useful part of their education.

If a definite time for practical experience must be set in advance, I should say that two periods of about four months each in different works, or one period of a year would be about right; but in this, as in all other matters of technical education, it is far better to make the regulations somewhat elastic in respect of field work and advanced study. Much time can be saved the students, and their work made more effective, if each case is separately considered by the responsible head of their school.

The final studies may now be considered. The student fresh from the field, but not yet forgetful of school methods, usually begins this advanced work with enthusiasm. The teaching may now be distinctly specialised and quite technical, but care must be taken to keep fundamental principles in sight, and the detailed technical work should be carefully laid out to cover only certain important typical operations. This academic work can be made much more interesting and effective by the free use of technical laboratories, in which engineering machinery (and in our case ore-dressing and metallurgical apparatus) can be used; but here, as in the lecture-room, care must be taken to teach principles, not processes. Certain processes must of course be used, and a good deal of careful detailed work done; but the primary purpose must always be to teach general principles, and mere technology must be kept in a secondary place. The best function of laboratories, aside from the limited use necessary to illustrate fundamental principles, is to develop the individuality of the students. Each man should be given certain carefully selected pieces of independent work, and he should be encouraged to attack the task in his own way. One or two comparatively heavy investigations are far better than many short experiments, and the instructor in charge can often do his men far more good by showing interest, and yet letting them work out their own salvation whenever possible, than by being too ready to set up apparatus and smooth over difficulties. This advanced individual work can utilise to the full the resources of even the most magnificently equipped laboratories; but care should always be taken, especially in schools which like my own are very rich in practical apparatus, to see that the students do a few things thoughtfully, and with a clear apprehension of their bearing, rather than that they get shallower experience of many processes and machines.

In connnection with this advanced study the men should be taught to write up their work, and to apply the knowledge gained in works, laboratories, and lecture rooms, to some practical problems in engineering. In this, questions of estimates and costs should be considered, for our men now are about to go out into the world, where costs from an essential element in every enterprise. Estimates made even by advanced students are likely to be far from right, but their preparation gives the men extremely valuable experience, and a competent instructor can do excellent work by discussing economic matters with his men in this stage of their training.

This should end the school course in engineering, for no amount of mere teaching will turn a boy into an engineer. still less into a mining engineer. If, however, we give him a good grounding in science and the principles of engineering, then put him in touch with practical engineering work, and finally teach him the elements of the technology of his subject, we shall have prepared him as well as any school can prepare a man to go out into the world and learn to become a good engineer.

The course that I have outlined is, I think, decidedly better than anything that is now offered by the schools at Home or abroad, because it makes a certain amount of practical work obligatory, and yet connects and even combines this work with at least as much theoretical and pure science study as is now required. It has, however, the disadvantage of taking four or five years, instead of three or four as at present, and it presupposes the most cordial support of the works and mine managers.

The feeling of managers and superintendents has changed greatly in the last few years, and tolerance, at least, can now be counted on, even when warmer feelings are still lacking; but even the most friendly manager cannot be blamed for feeling some hesitation about subscribing to a scheme that will require him to regularly take on student workmen. He will say that such boys are in the way, do not earn their pay, add to his anxiety, cause dissatisfaction among his regular workmen, and in the end leave him and go back to school just when they are beginning to be of use. If he is very well disposed, he may even ask to be let off with a contribution to the school funds, or to some approved charity. If he is a mere man, his request will be quite different. The objections stated are all quite real, but like objections to many other good things they become comparatively unimportant when fairly faced. A few years ago I persuaded some of my friends in Canada and the United States to try the plan, and gave them each one or two young men for the experiment. The students did not prove troublesome, quickly made friends among the workmen, and in many cases even earned their pay. It is true that they had to go back to school after a few months, but not infrequently they took back with them a promise of permanent employment and returned to the mine immediately after taking their degrees. In brief, the managers have found the difficulties far less than they expected, and in part, at least, counterbalanced by the fact that they now come to know intimately a number of young men from whom they can select the best later, if they need to increase their staff. Nearly every manager who has tried the plan is willing to take on the next year, and some have become really interested in the students, on whom they are able to confer such great benefits, and thus have become active and invaluable assistants in the work of mining education.

I make no claim to have been the first to use this means of supplementing a mining school education. Individual students have done holiday or interim work in mines ever since mining schools began; but it does not give me great satisfaction to be able to say that my friends, the mine and smelter managers, have come forward so cordially, that for several years I have been able each summer to secure an engagement at at least living wages for every boy in my classes who has been willing to work. Over 80 per cent. of them do actually work in this way each summer, although our regulations do not as yet require them to do so.

One other difficulty in my plan is that it requires a larger staff of instructors than ordinary teaching, and these instructors must be good men, heartily interested in their work. Formal lectures and set exercises may perhaps be acceptably given to classes by men whose chief interest is outside the class room; but no man can succeed in such close individual teaching as I have recommended, unless he give his whole time and his whole heart to his work. The responsible heads of the several engineering departments of the school should be men who have had considerable and successful practical experience, and they must keep in touch with their profession by travel, and by taking occasional professional and consulting engagements. This not only keeps them fit and fully informed, but it greatly strengthens their influence with their students. Their professional work must, however, be completely subordinated to their main duty of teaching. There are few professions that require more constant and earnest effort, and the men who are to guide the final professional studies of young engineers must be free from conflicting or diverting interests.

The subordinate teachers need not all be experienced men, in the sense of having spent many years in works, but they should be sufficiently familiar with practice to fully appreciate the professional or technical bearing of the subjects taught. Practicing engineers should also be engaged for occasional special lectures, or short courses. If these men are eminent in their profession, they will stimulate the students greatly, and will also have a good effect on the regular members of the teaching staff.

TACTICS AT THE LE ROI MEETING.

A circular letter has been issued to shareholders of the Le Roi Company, by Mr. C. Williamson Milne, whose statements substantiate the view we took in last month's issue of the MINING REVIEW, regarding the unfair practice that was used by Mr. McMillan and his supporters at the recent meeting of his company. After referring to the fact that he was unable to obtain a hearing at the meeting, in consequence of the opposition of McMillan's supporters who appeared to be determined that no one except those who were prepared to attack the Board should have a patient hearing, Mr. Milne states that although, since giving his views with regard to the benefits likely to accrue to the Le Roi by amalgamation, he has since heard that a number of the present shareholders are opposed to the scheme. He uses the words "present shareholders" advisedly, for he states it has been an open secret in the city for a long time that certain interested parties had been buying for control, and that the nominees into whose names the shares were going would vote according to instructions, and against amalgamation.

The circular states: Some of us should much like a disclaimer from Mr. McMillan that he is in any way directly or indirectly associated with these astute Americans. The innocent fashion in which some of the provincial shareholders have been led to believe that there was an organized conspiracy between the Board and the representatives of the Canadian companies to practically "steal" the Le Roi property would be amusing if it were not deplorable.

Mr. McMillan has spoken of various valuations placed upon the Canadian Smelting Works, which are owned by the Canadian Pacific Railway. These valuations have not differed to any extent. In the first instance Mr. McMillan is discussing a price provided in a cash option at £120,000, which checks closely the valuation made at a later date by John H. Mackenzie, viz.: 18 per cent. of £800,000 or £144,000, payable not in cash but in shares, and including I understand, all additional plant and machinery added after the date of the option referred to as well as the Trail concentrator, which Mr. McMillan says cost some £60,000. In the second instance, by taking 18 per cent. of £1,100,000 (£198,000), Mr. McMillan is giving you a valuation not upon the Trail smelter plant alone, but upon plant, plus cash contribution by the Canadian Smelting Works for working capital, coke, coal, limestone, stores, and supplies.

Reference to the valuation by Mr. Mackenzie is made on page 7 of the director's report as being about £800,000 and distinctly states that, instead of distributing £800,000, the value of the combined properties and plants, that £1,100,000 is to be "divided proportionately". The difference between £1,100,000 and £800,000 was to pay the respective companies for their cash contribution (working capital) plus coke, coal, limestone, stores and supplies, which were to be determined finally by Messrs. Clarkson, Cross & Helliwell, chartered accountants and local auditors, for all the mining companies, including the Le Roi Mining company. This amount of £300,000 would probably have been more than the value of the above, and any balance would have been left unissued or distributed proportionately between the various companies.

Mr. McMillan explicitly stated at the meeting that he was personally offered £15,000 provided this scheme went through. When opportunity offered, I pointed out that a public statement of this kind, unsupported by any evidence, left a most monstrous imputation on every gentleman who had been connected with these negotiations, and that Mr. McMillan was in duty bound to disclose the name of the parties who made the offer—but I tailed to elicit any response.

The Centre Star and War Eagle are and have been producing about 15,000 tons monthly of ore similar in grade to the 10,000 of 12,000 tons being produced by the Le Roi, while the St. Eugene is mining 12,000 to 15,000 tons monthly from which are produced 2,500 to 3,000 tons of lead concentrates of a gross value of about £13 per ton. If the Canadian lead bounty were cancelled, the St. Eugene could sell every ton of concentrates in Europe and net as much as they are at present receiving.

Mr. Aldridge informs me that the Canadian companies earned last year, over and above all expenses, improvements and construction £180,000. They have a cash reserve of £162,000 earned through operations.

Throughout the whole of the controversy, Mr. McMillan has repeatedly made statements which call for confirmation. The proposal to loan a blower (costing when new about £400) to Trail smelter, on business terms, advantageous to the Le Roi company, becomes the dismantling of the Northport smelter and a hysterical application is made to the United States courts for an injunction. We have six blowers at Northport and have seldom used more than two and never more than four at the same time in the past three years, so that we could have suffered no loss, but stood to gain (if we elected to sell) by this friendly act.

Mr. McMillan complains of vulgar personal abuse aimed at him by the directors. I have referred to the circulars issued by the board, but they bear no evidence of anything of the sort. On the other hand the reference to Mr. Geo. S. Waterlow in Mr. McMillan's circulars are, to put it mildly, in the worst possible taste, and contain innuendoes that seem to border on the libellous.

Mr. McMillan prepared to recommend the payment of a dividend for the year ending June, 1905. By his own showing, only last year we were in such desperate straits for working capital that the Bank of Montreal asked for the deposit of the title deeds to our property. A dividend of only 4 per cent. would absorb roughly, £40,000 and we have not got the cash with which to pay it. Such cash as we have is urgently needed for working capital, but Mr. McMillan would deplete our cash resources as cheerfully and recklessly as he has depleted the mine of its ore reserves, and again go back to the old policy of "trusting to luck and to the clemency of the Bank of Montreal." Such a policy is fatuous in the extreme. If luck is with us again it may succeed, if otherwise, disaster will follow; but why risk disaster?

We have a mine in the Le Roi with magnificent possibilities, but you must give it a chance by spending considerable sums of money on energetic exploration and development work.

From the "alone I did it" tone of his circulars, one would almost infer that Mr. McMillan had at any rate discovered the pay ore shoots in the mine, if indeed, he did not place them there. He did neither, and he cannot guarantee to keep up the present ore shipments for any lengthy period, and at the same time increase the payable ore reserves in the mine.

It seems fair to assume that if returned to power Mr. McMillan will at the earliest opportunity restart the Northport smelter, notwithstanding the fact, which seems to me to have been conclusively proven, that by doing so the Le Roi company loses one dollar, at least, on every ton of ore smelted. For years past, the Northport smelter has proved a sump for the revenues of the Le Roi company. I have applied for and obtained the official figures from the 30th June, 1901, to the 30th June, 1904, showing the deficiencies on the Northport smelter, figures, due to over-estimation of profits. These deficiencies have only been ascertained at the various periods when the Northport smelter has been cleaned up. In the aggregate, the difference between the estimated valuation of profits and the actual results has been no less a sum than £172,000. Either there has been gross miscalculation on the part of the smelter managers or the metallurgical losses have been enormous. The figures for each year are as follows:—

Deficiency for year ending:—

June 30, 1901	$250,000
June 30, 1902	233,000
June 30, 1903	129,622
June 30, 1904, (say)	250,000
	$862,622

being equal to £172,524.

In view of the facts which have been submitted to us with reference to the Northport smelter, it would be madness to return Mr. McMillan, or his nominees to power without having a definite assurance for him and them that the Northport smelter will not be reopened. This, it seems to me, is one of the main issues of the controversy.

What, then, are Mr. McMillan's qualifications for the post. In his circulars he has made several references to the lack of practical knowledge on the part of Sir Henry Tyler and Mr. Waterlow. Where and when did Mr. McMillan get his practical and technical training in mining and metallurgy? Up till about 1897 he was emigration officer for the Province of Manitoba. Since then he has been a mining broker in Rossland and associated with the following companies:

British Columbia (Rossland and Slocan) Syndicate, Limited.

The Snowshoe Gold and Copper Mining Co., Limited.

None of the numerous properties owned by these companies, so far as I can learn, are operating at a profit to-day in Canada. During his tenure of office with the Le Roi he has, despite the expressed wishes of its chairman, persisted in sending the Le Roi ores to Northport resulting in the reduction of the company's profits during the past year alone by a sum of no less than £20,000.

Mr. McMillan has indulged in a number of cheap sneers at Messrs. Bradley and Mackenzie, the consulting engineers, who have been placed in charge of the Le Roi mine. Mr. Mackenzie's policy has never been proved to be wrong; indeed, Mr. McMillan has taken credit to himself for results which were largely due to the directions given by Mr. Mackenzie. Messrs. Bradley and Mackenzie are consulting engineers in the western states of U.S. to Messrs. Wernher, Beit & Co., and to the Exploration Company Limited, of London. These concerns do not have the reputation of being content to employ engineers who are not in the first rank in their profession. Messrs. Bradley and Mackenzie are also consulting engineers of the Alaska Treadwell, Alaska Mexican, and Alaska United, three of the first mining properties on the American continent. Mr. Bradley is president and consulting engineer of the Bunker Hill and Sullivan mine in Idaho, the largest silver-lead producing mine in the United States.

It is the advice of men controlling interests such as these which Mr. McMillan affects to despise, setting up in opposition the views of himself and one or two subordinates appointed by him. After the attacks which have been made upon them, there is no hope that Messrs. Bradley and Mackenzie will continue, even if asked to do so, to operate the Le Roi property, but it is interesting to turn for a moment to the comparative expense under their regime and that of Mr. McMillan.

Messrs. Bradley and Mackenzie agreed to act as managers and consulting engineers for a fee of £1200. With the smelter shut down the only additional executive officers whom the company would have required to pay were, mine foreman at a salary of £600 per annum and a competent office manager at a salary of £500—altogether £2300.

Under Mr. McMillan, his own salary, at one time £2500, latterly reduced to £1500. Mr. Astley, mine superintendent, received £1600; Mr. Goddell, the smelter manager, £1600; the manager of the Rossland office, £720; and the mine foreman £720. The office manager at Northport £600; bookkeeper at Northport £300; and the mine representative at Northport (Mr. McMillan's brother), £360; altogether £7400. An object lesson, this, in economy!

Now I wish to put myself right in one particular. It may be remarked that at the meeting of the Le Roi shareholders in January 1905, I said: "I think it is due to Mr. McMillan that the shareholders of this company should expressly thank him for the way in which he stood in the breach, when, in September last he took up the general managership of the company on terms which, if the amount is any criterion, indicate a very modest scale of remuneration indeed."

The accounts for 1904 showed that Mr. McMillan had received as managing director, in salary and expenses, the sum of £625. I never dreamt at that time that Mr. McMillan was likely to rate his abilities at £2500 or even £2000 per annum, and I would have been just as ready to characterize as monstrous, such a scale of remuneration as I was prepared to commend the payment of £500 as a modest fee for his commercial services.

REMUNERATION OF BOARD.

I would remind the shareholders that the present board have worked for three years without fee or reward of any kind and that if Mr. McMillan's advice is taken and a dividend paid, the directors are entitled to participate, and will receive remuneration for the first time. That they have not recommended a dividend is in itself conclusive evidence that their policy has not been a personal or a selfish one, but conceived only in the interests of the shareholders.

The only director who has made money out of the company during the past three years is Mr. McMillan. Mr. McMillan has doubtless worked hard, and done his best according to his knowledge and ability, but he has already been handsomely paid for any services he may have rendered in the past.

REPORT OF THE MINING COMMITTEE OF THE HALIFAX BOARD OF TRADE.

The annual meeting of the Halifax Board of Trade was held on January 16th. The Mining committee presented the following report:—

Mining has not received the careful consideration, attention and support from the members of the committee its magnitude and more extensive possibilities would seem to demand.

When we seriously reflect, it must be apparent that the commercial, economic and political prosperity of this province, and particularly the City of Halifax, depends largely upon the successful development of this most important branch of our commercial life; and further reflections must reveal the necessity of a serious and well organized campaign by the members of this board, if we are to broaden and strengthen this corner stone of our commercial foundation.

It has occurred to me that perhaps in some instances, we have exerted our energies on subjects minor, and left the major ones to shift for themselves. However, I trust the present year we may record a more active and energetic movement by its members in the support of this the most important of our provincial natural resources—its mines.

Coal Mining.—Owing to severity of the weather during the winter of 1905 and the re-establishment of the duty on coal going into the United States markets, there has not been the increase in the production of this commodity as was anticipated.

Many of the mining companies have however, enjoyed a large share of prosperity; prices have been successfully maintained, with no immediate prospects of depreciation in either price or output. Unfortunately the local consumer does not enjoy the same degree of satisfaction—to whom there seems to be no immediate prospect of relief. It is an open question whether or not the present existing conditions are not detrimental to other important branches of industries. However, the remedy, if one is desired, remains in the hands of the consumer, rather than in those of the producer, as is generally supposed.

In Cape Breton new prospects are being developed on extensive plans made for larger output in the near future. In the Pictou field two new shafts have been sunk, one to the Ford, the other to the cage pit seam. When these mines are fully developed they will largely augment the output from these fields. At DeBert and Maccan satisfactory developments are being carried on; while in the western part of Cumberland County there is said to be a new and extensive field yet undeveloped, portions of which are being prospected by the Standard Coal and Railway Co., who are said to have already cut a ten-foot seam. This field, when fully developed, should add largely to the natural resources and wealth of the Province.

Iron Ore.—Iron ore deposits are receiving more recognition, but not as much as we would desire. While the future looks extremely encouraging and with proper and sufficient inducements many promising prospects should develop into fairly large proportions. And could the bounty now paid by the Dominion Government on metallic iron made in Canada be so apportioned that specific bounty would be paid to the producers of Canadian iron ore there would then immediately spring into existence a large number of individual mines.

When we seriously consider that were an export duty to be placed upon raw ores now being imported and used by the steel plants of this province it would seriously cripple, if not entirely destroy these industries, which have cost people so much, makes this problem one of extremely vital importance to the people of this province, and further shows the wisdom of placing the industry in a position absolutely independent of any foreign manipulation. The independence of the industry should be maintained, but this can only be done by encouraging the development of raw material found within our own Dominion or provincial limits.

I would, therefore, strongly advise the appointment of a committee from this Society to more fully consider this question in all its branches; that this committee should be instructed to place its finding before the Tariff Revision Commission, urging the necessity of the re-adjustment of the bounty now paid in favor of the producers of native ores.

The Mining Society of Nova Scotia, already alive to the situation, and its importance, have appointed a committee to deal with this matter, and a unity of these two committees is strongly recommended.

Prospecting for Oil.—During the year 1905 prospecting for oil had been continued at or near Cheverie, and, as I understand without any discouraging features being met with, and that prospecting will be continued during the coming summer.

Gold Mining.—There has been little or no marked improvement in this industry during the past year.

At the suggestion of a committee appointed by the Mining Society of Nova Scotia, the local government was induced to employ an expert engineer to examine into the gold fields of this province and to report on the same. This examination has been made, and results are anxiously looked for.

This industry is one of decided importance to the City of Halifax, and should receive greater recognition from this Board, as the present depressed condition means a loss to the city of not less than $500,000 per annum.

The Mining Society at its next annual meeting will no doubt go more fully into the subject and possibly make further recommendations to the Government, and the co-operation of this Board will strengthen their position.

(Sgd.) A. A. HAYWARD,
Chairman Mining Com.

A BANK MANAGER ON MINING IN CANADA.

At the recent annual meeting of the shareholders of the Canadian Bank of Commerce, an interesting report was submitted by the general manager. Regarding mining in Canada during the past year, reference was first made to the gratifying and important industrial fact of the further improvement in the conditions surrounding the manufacture of iron and steel, and particularly the beginning of the manufacture of rails, the excellent quality of which was at once demonstrated in the Maritime Provinces. In Ontario, it was stated, interesting mining has been stimulated by the discovery of the rich deposits of silver-cobalt ores in the Cobalt area. It is stated that several million dollars worth of ore will be taken from these veins within the small area mentioned. Allusion is made, however, to the refractory nature of the ores, but the hope is expressed that before long a satisfactory method of treatment will be available. The report proceeds to say that during the coming summer there will probably be a considerable influx of population into the district surrounding Cobalt, and signs are not wanting that an attempt will be made to create not only a mining, but a mining stock boom. The report remarks that serious losses to the public have in the past resulted from attempts to capitalize mere prospects which only producing mines should command, and it is hoped that no encouragement should be given to any movement of the kind.

In Saskatchewan and Alberta, each of which provinces are much larger than Manitoba, coal, oil and other natural resources are now being developed.

In British Columbia coal mining shows a handsome increase in production, and several new mines are being opened. It is stated that there seems to be no reason established, in view of the unlimited supplies of raw material, why British Columbia should not take its place among the great coal-producing countries of the world.

Copper mining and smelting are now established and profitable industries. They require large capital and completed technical knowledge, but the results of such a combination seem to be as sure as in other well-managed manufacturing businesses. The year's output of the Boundary mining district is about 1,000,000 tons. There is a marked improvement in lead and silver mining and the outlook seems better than for many years.

ONTARIO MINING INTELLIGENCE.

FROM OUR OWN CORRESPONDENT.

Before the Canadian Section of the Society of Chemical Industry, Prof. Miller recently read a paper on the Mineral Deposits at Cobalt. Referring to the richness of Northern Ontario he pointed out that nickel of the value of from $50,000,000 to $60,000,000, in a refined state, had been produced in the Sudbury district. Eastern Ontario was also rich in minerals, mica and corundum superior to any in the world being produced there. There are three magnetic metals in nature, all of which are found in Ontario. The educational system was largely to blame, Prof. Miller thought, for the slow development of the province. He cautioned the people against booms—mining on paper. Only 7 per cent. of the mines in the Yukon had paid. So great was the demand for information about the Cobalt district that 7,000 maps had been distributed by the Bureau of Mines, and 9,000 more had been ordered, 5000 copies of the report had been distributed and more were wanted. Inquiries were coming from all parts of the world. Referring to waste in mining, Prof. Miller stated that $3,000 worth of sulphur was lost every day at Sudbury in the roast heaps. In the course of the evening Prof. Miller exhibited a number of German nickel coins and strongly advocated the adoption of a nickel coinage for Canada.

Proceedings have been taken at the instance of the Ontario Government to set aside the leases held by the Temiskaming and Hudson's Bay Mining Co., the Nipissing Mining Co., and the White Silver Co., on the ground of fraud and misrepresentation, it being alleged that there was no valuable discovery made at the time the leases were applied for. In each case transfers have been made, the present holders not being the original lessees. This complicates the case, the present holders, in some cases at least being innocent parties who obtained mining rights for a valuable consideration.

A branch of the Canadian Mining Institute of Canada has been formed at Toronto. Mr. Eugene Coste having been elected chairman, Mr. W. Dillon-Mills, secretary, and Mr. Geo. R. Mickle, treasurer. One of the first acts of the branch will be to take up and discuss the proposed changes in the Ontario Mining Law.

The annual meeting of the Canadian Society of Civil Engineers was held at Toronto, Jan. 30, 31, Feb. 1, 2. The only paper bearing directly on mining was one by Dr. J. B. Porter, of McGill College, on Diamond Mining at Kimberley, South

Africa, illustrated with lantern slides. It was full of interest and the audience was most appreciative.

Samples of steel made by the electric process at Deseronto, have reached the Bureau of Mines at Toronto, and appear to be of excellent quality. They are produced from sulphurous ore from the Coe Hill mine and titanium from the Horton mine. One sample was produced in 15 and the other in 20 minutes. The steel was produced direct from the ores, but the experiments were merely conducted on a small scale by way of laboratory test.

The Canadian Copper Company's new smelter at Copper Cliff is now in operation. The cost of the works was approximately $100,000. The plant, which has a capacity of 10 tons a day, is not adapted for saving the cobalt or other constituents of the Cobalt ores with the exception of the silver and arsenic.

A German Syndicate is said to have been formed to explore for minerals in Canada on an extensive scale and is said to have unlimited capital at its disposal.

Mr. Controller Jones is our authority for the statement that negotiations for the establishment of extensive iron smelting works in the east end of Toronto have reached such a stage that the works are now practically assured, in order to treat Hutton and Temagami ore, which will be delivered on the spot by the James Bay and Grand Trunk railways.

Judgment has been given by the Court of Appeal for Ontario in the case of the Wakefield Mica Co. The liquidator appealed from the judgment of Judge Anglin, but the appeal was dismissed. Messrs. J. S. King and C. A. Johnston are held not to be contributories and that the Mica Co. was never validly organized, no meeting of the shareholders or directors ever having been held.

A very valuable discovery of iron ore has been made north-east of Sudbury. The ore is very low in sulphur and phosphorus and will make a Bessemer steel of high quality. Railway facilities will be afforded, it is stated, if the ore proves as valuable as is at present believed.

Messrs. MacKenzie & Mann have secured an option for which they are said to have paid $10,000, on a group of iron properties in Hutton and vicinity.

As a way out of the difficulty about the Gillies timber limits adjoining Cobalt, Mr. J. M. Clarke, K.C., proposes that the mining lands within the limits be handed over to the provincial university to provide an endowment. Some Ontario papers speak favorably of the proposal, and the university authorities are urging the government to act on the suggestion.

Diamond drill tests on the iron property at the north-east angle of Lake Temagami have afforded satisfactory results, and it is said offers have since been made for the property which is owned by Mr. T. B. Caldwell, M.P., Sir Wm. Mulock and Mr. E. O'Connor of Temagami.

A dispute has arisen over the ownership of the Violet mine in the Township of Bucke. The Hon. F. Cochrane, Minister of Lands and Mines has meanwhile heard the evidence and reserved decision. Mr. H. J. M. Rothschild, of New Liskeard, is the claimant. The mine has been worked for some months by Mr. J. O. Handy, of Pittsburg.

A United States syndicate has secured an option for, it is reported $150,000, on the Tip-top copper mine, situated on the line of the Canadian Northern Railway, about 80 miles west of Port Arthur. The mine is owned by Lt. Col. Ray, of Port Arthur; Folger Bros. of Kingston and some United States investors.

An offer of $1,000,000 is understood to have been made for the Tretheway mine at Cobalt. Mr. W. G. Tretheway, who has the largest interest, was disposed to accept, but his partners deemed the offer a not sufficiently tempting one.

Recent tests of the copper ore found at Cloud Bay, near Port Arthur, show very satisfactory results, samples having yielded as high as 26 per cent. The vein is said to be identical with that of the Calumet mine and is 23 feet wide in some places. A Boston company is meanwhile arranging to work the property.

Mr. Wm. Curtis, who was connected with the Silver Islet mine when it was producing heavily, passed through Toronto recently on his way from Cobalt where he had been making investigations on behalf of Detroit investors. Mr. Curtis expressed a very favourable view of what he saw in the new silver district.

The Michipicoten Gold Mining Co. having leased ten claims is making arrangements with the Michipicoten Power Co. for power for a fifty stamp mill which the company propose to erect. The Company's representative is Mr. J. J. Heilmann of Pittsburg.

Captain Lawson, mine superintendent at Copper Cliff, has been promoted to be general manager of the Canadian Copper Co's works.

Edison having secured mining claims on the Montreal River, is arranging for the accommodation of the men to be employed on the work.

Companies are announced almost every day to exploit Cobalt properties The best properties are not for sale, and many of the new concerns have no property, or if they have it is not within the mineral belt. There are indications of many wild-cat schemes. One advertisement announces that there is a vein of calcite on the promoter's property. Probably the statement is true, but it is probably intended to deceive the ignorant who are not aware of the nature of calcite. There is every prospect of a great rush to Cobalt in the spring and doubtless wild-catting will be very general.

The sub-station of the Huronian Power Co. at Copper Cliff is nearing completion and power from High Falls was expected to be produced on about Feb. 1. The station is built of iron and concrete and when completed will have cost over $250,000. It will be of great service in furnishing power for mining and smelting operations.

COAL NOTES.

NOVA SCOTIA.

At a meeting held at Glace Bay on January 22nd, at which were present representatives of the Dominion Coal Company, of the Government and of the P.W.A., the report was submitted embodying the tests made during the past few months, in connection with the different powders used at the several collieries. A decision was finally arrived at that the companies would supply Bobbinite and Bull Dog powders, and that the men were to be allowed to use which they pleased. In the matter of price it was agreed that the company should supply the powder at a reduction if the matter can be arranged with the powder manufacturers.

The Dominion Iron & Steel Company's rod mill will be closed down for several weeks as the supply of wire rods on hand is at present greatly in excess of market requirements. Several thousand tons of wire is now in storage in the company's warehouse, ready for shipment.

Tests continue to be made of Crow's Nest coal for railway purposes, some recent results having proved most satisfactory in competition with other western coals; thus, a test made by the engineers of the Northern Pacific Railway yielded the following results:—

Pounds of water evaporated per pound coal at feed temperature, 33 degrees F., 8.1.

Pounds water evaporated per pound coal from and at 212 F., 9.95.

Pounds coal burned per 1,000-ton-mile on up grade of 0.25 per cent. for 115 miles, 120.19.

BRITISH COLUMBIA.

It is reported in consequence of the present increased demand for coal lands in Alberta and Saskatchewan, and in the B.C. Railway belt, that the Department of the Interior has decided in future that if the first instalment of the purchase price is not paid before the expiry of the period allowed an applicant when an application is accepted by the department, his right under the application will be held to have absolutely lapsed. When payments have been made on account the rule will be on and after April 1st next, that if the payments are not made on the date fixed by the terms of sale, the rights of the purchasers will be forfeited. If a purchaser does not wish to complete the payment on the whole of the tract covered by his application, and he so notifies the department before the 1st of April next, he may be permitted to apply the amount which he has paid on the whole tract to a portion thereof, in such a way that his amount may complete the purchase of such lesser portion of the original tract.

It is reported that the well known railway magnate, Mr. D.C. Corbin, and others, have recently completed the purchase of 17 square miles of coal lands in the Crow's Nest area, some 60 miles east of Fernie, and adjoining the C.P.R. coal lands.

In his annual report for 1905, J. W. Harrison, broker, of San Francisco, reports the consumption of coal during this period in that market as having been 219,182 tons less than that of the preceding year. The report states that this shrinkage must not be taken as an indication that our fuel requirements have been at all less than in 1904. The apparent diminished quantity of coal fuel has been much more than made good by an output this year of fully three million barrels of fuel oil in excess of last year. The quantity of coal shipped here from British Columbia is in excess of last year shipments, whereas the Australian amount has shrunk fully 40 per cent. A new feature has recently developed itself in colonial deliveries being made here by steamers, there are several already chartered which have yet to arrive, with freight at about 16 shillings per ton, and with the duty of 67 cents per ton, the importers receive a very small compensation for coal; less than one-half the amount demanded for British Columbia coal at port of shipment.

The quotations of coal of all grades have ruled very uniformly throughout the year. the prices of steam grades have favored buyers having fuel oil for a close competitor. The labor disturbances in British Columbia, which lasted for about six months this year, served to diminish the importations from Nanaimo section, and helped to increase the colonial importations, both as to quantity and price. Favorable terms were reached in November last, and work has been recommenced, and is now running harmoniously. About 80 per cent. of the coal trade is under the control and supervision of one firm locally. This is found to work with advantage to the buyers, and the sellers as the material can be handled so much more economically, and prices are sustained more unfornly. There are six steamers now being utilized by the firm transporting coal from British Columbia only. The last deliveries here of the six steamers amounted to over 24,000 tons, partially for steam purposes, and partially domestic grades.

The following comparative table shows the origin and tonnage of coal delivered in San Francisco during the past three years:—

	1903 Tons	1904 Tons	1905 Tons
British Columbia	289,890	335,137	348,515
Australia	276,186	148,409	85,031
English and Welsh	61,580	64,664	65,087
Scotch	3,495	1,666	None
Eastern (Cumberland and Anthracite	13,262	29,055	11,663
Seattle (Washington)	127,819	139,063	84,965
Tacoma (Washington)	256,826	182,313	81,480
Mount Diablo, Coos Bay and Tesla	84,277	96,520	114,930
Japan, and Rocky Mountain by rail	102,219	54,245	40,219
Total	1,215,554	1,051,072	831,890

REPORTS AND MEETINGS.

Le Roi No. 2, Limited.—At a meeting of this company, held on the 15th of January, a report was submitted showing a balance to credit of profit and loss account of £29,810, after writing off the sum of £13,911 against mine development and £3,924 as depreciation on machinery and plant, buildings, etc. There was brought forward from the previous year the sum of £28,690, and after paying a final dividend for 1904 of 2s. per share there remained the sum of £16,090, which with the present balance of £29,810, gives a total of £45,901 available for distribution. Out of this a dividend of 1s. per share was paid on the 7th of October, absorbing £6,300. The directors now recommend a final distribution for 1905 of 3s. per share, leaving £20,701 to be carried forward. Messrs. Hill and Stewart report that during the past year the development of the mine has been vigorously pushed with highly satisfactory results, 12,237 tons were shipped to the smelter, and 10,678 tons to the concentrator. The mining expenses for the year, including diamond drilling, show an expenditure of $4.22 per ton as compared with $4.45 the previous year, although the tonnage dealt with has been less. The company has taken advantage of an opportunity that occurred to acquire various claims in the Rossland and Ymir districts, but has relinquished the option over the Vernon-Thompson group. Mr. Couldrey, who occupied the post of mine manager during the years 1903–4, has now returned to Rossland and taken charge of the property.

Denoro Mines, Limited, (Rossland).—Mr. Smith Curtis, managing director, has issued the following circular to sharehol-ders:—

Since the last annual meeting, mostly development work has been carried on at the Oro Denoro mine. Sufficient ore has been taken out to meet the expense of mining, etc., so that the financial position of the company continues to be sound. The work of exploration carried on at various places on the property has shown that there is a reasonable certainty of a large tonnage of ore of at least as good grade as that being shipped by the Big Boundary Copper Mines to smelters operated in conjunction with such mines. Were there a Custom Smelter buying such ores the Oro Denoro could maintain a large output. As it is now, it is only ores of special quality that the smelters will take from the Oro Denoro.

A large body of ore was last summer and fall stripped of a deep layer of earth so as to permit its being quarried. This ore lies on the hillside between the two railway lines crossing the property and was ready for mining early in November but the Great Northern Railway failed to observe its contract with your company and complete a shipping siding until a few days ago when the siding was at last finished and since then 800 tons have been sent to the Granby smelter and other shipments are under way.

It is too soon to tell how this ore body will turn out in values, but it is believed to be payable at the rates quoted by the smelter. If so regular shipments will be made from it.

Two months ago arrangements were made to acquire a half interest in the Hungry Man mine situate three and one-half miles from Slocan Junction, a station on the C.P.R. branch line between Nelson and Castlegar. One-fourth of this mine has been bought and paid for. The development work to date has been fully up to expectations and a payable ore body has been followed down 33 feet. A steam hoist and pump have been installed and will enable work to be done more cheaply and expediously. The ore is pyrrhotite carrying an average of about $20 in gold. As this interest at the present time seems likely to become a valuable asset of your company, the annual meeting will not be held until some time in February when it will be possible to give more certain information about it.

Skylark Developing Company, (Boundary District).—The annual meeting of this company was held in Phœnix, during January, the directors being re-elected as follows: The president, Mr. A. B. W. Hodges, vice-president, Mr. R. B. Boucher, M.D.; directors, Messrs. H. A. Wright, C. D. Hunter, W. S. Macy. Mr. A. B. Hood was re-elected secretary-treasurer, and Mr. O. B. Smith, junior manager. The report of the manager, for the year, was of a favourable character. The development work done comprised 1,071 feet, and 535¾ tons of ore were mined and shipped to the Granby and Nelson smelters. At the 150 ft. level the ore body was again found to be faulted, but by cros-cutting to the east a very short distance, the vein was found again in place. The difficulty of determining the amount of ore now in sight is pointed out in the report. An estimate of 490 tons of high grade ore is presented as a very conservative calculation.

MINING NOTES.

NOVA SCOTIA.

A very remarkable showing was made during the month of December by the Dominion Iron & Steel Company, all previous records in every department having been surpassed, and a new record established, particularly in the output of wire rod.

The total production of pig iron last year was 162,000 tons, of the open hearth steel furnaces 173,500 tons, and of the rolling mills 47,000 tons. The steel rail mill turned out from the time it was first operated in June 44,000 tons. These were all 80-pound rails of uniformly good quality and practically all were delivered against contracts. Shipments were made under rigid inspection to the leading railroads of the Dominion and contracts are now in hand which will absorb the output of the mill for some months. The monthly production gradually increased until the end of the year, December having nearly 10,000 tons to its credit. This is not the measure of the mill's capacity, over 600 tons having been rolled on a single day and on several occasions it was proved that it is possible to roll 1,000 tons a day.

It is believed that upon the return of the President, Mr. Plummer, from England, the company will be re-organized and placed on a better financial footing

The company is now confronted with the following charges in round figures:—

First mortgage bonds	$390,000
Second mortgage bonds	150,000
Sinking funds, first mortgage	55,000
Sinking fund, second mortgage	250,000
Total	$845,000

The preferred dividend requires $350,000, making a total of $1,195,000 of obligations ahead of the common stock. The company must thus earn $100,000 a month from operation to pay interest, sinking fund and preferred dividend requirements. The accumulated dividends on the preferred stock including the April dividend will amount to $21 per share, or $1,050,000. There is also the floating debt to be taken into consideration. The general understanding is that under the re-organization plan the second mortgage bonds will be retired by the issue of another security, the preferred stockholders will be asked to agree to having their shares put on an 8% basis, thus receiving back dividends at the rate of 1% per annum. With the retirement of the second mortgage bonds and the removal of the $250,000 required for the sinking fund for that issue, the increased production possible, the excellent business in prospect, a brighter day should be dawning for the long suffering holders of Dominion Iron & Steel common, and the shares have even now started to reflect the good news which is coming from the property.

Shipments from the Dominion Steel Company's works, during January, aggregated approximately 17,000 tons.

QUEBEC.

In an article headed "Exit the Anglo Canadian" the Buckingham *Press* comments in the following amusing fashion:—

"There was not a fire at the premises of the Anglo-Canadian Graphite Syndicate, Limited, recently, but some people saw Sparks. The sale in connection with the company then took place, and the movables were disposed of. The result of the sale is not very encouraging for the creditors. The liabilities foot up something like $8,000.00 (eight thousand dollars) and the proceeds of the sale, gross we mean, come to about $750.00 (seven hundred and fifty small dollars). Out of this sum will come the law costs and advertising, and the fees of the permanent liquidator. Less than 10 per cent. of the liabilities has been realized at this sale, 90 per cent. of which will go to satisfy privileged claims unless we are greatly mistaken. Over 600 cords of mixed wood went for a lump sum equivalent to 25 cents per cord. Four tons of steel rails with fish plates and bolts went for the sum of 8 dollars. One steam drill brought $70, another $5. There was a slight hope until the sale came off that operations would be resumed here by a new company of which Messrs. W. E. Duncan and Darcy McMahon were to be managing directors. But though Mr. Duncan was at the sale he did not purchase anything. The buying of the wood by him would have afforded ground for the assumption that operations would be resumed, but as it appears to-day the Carbondale business seems as dead as the proverbial door nail, snuffed out like a tallow candle. But perhaps McMahon and Duncan have something up their sleeves, not of the hair raising kind, but something all wool and a yard wide, don't you know. We hope so any way.

There is not much hope of the Weart mill resuming operations. If the International Company had really intended to re-open this mine it is quite likely the 600 odd cords of wood disposed of would not have gone for the price it did, but as a distinguished friend of ours says, "You can't mostly always generally sometimes tell."

ONTARIO.

The Big Master mine, after running, has again been obliged to close down, the recent clean-ups apparently having not been sufficient to more than defray expenses. The statements that have recently appeared regarding the value of the clean-ups made were, morover, doubtless exaggerated.

Five hundred and fifty oil leases in South Essex were filed in the county registrar's office during the year. The value of these leases is given as $1,318,179.00.

The concrete foundations for the Atikokan Ore Company's blast furnaces, to be erected at Port Arthur, have been completed and contracts for steel structural work and machinery have been let, the work being divided into fourteen contracts. The Canada Foundry Company, of Toronto, has secured $200,000 worth of the work; Canada Bridge Co. $100,000 and Caledonia Iron Works, Montreal, $20,000. The remainder of the contracts went to United States firms, and were for machinery not made in Canada. If contractors finish their work on time the company will start furnaces going next August. The mine at Atikokan is being equipped with the best machinery obtainable and the shipping of ore therefrom will begin as soon as navigation is open. A railway six miles long from the Canadian Northern main line to the mine will be constructed at once. The authorized capital stock of this company is $2,000,000.

A local paper publishes the following interesting note, regarding the alleged blanketting of claims in the Cobalt district:—

A sensational move by the Attorney General, Mr. Foy, to open up a large area of the Cobalt district, which it is claimed has been illegally " blanketted," was inaugurated on Saturday when Wm. Pinkerton, of Pinkerton, Clute & Co., issued the first instalment of writs on a wholesale scale. By noon 50 writs were issued at Osgoode Hall, and by Monday morning 100 more were issued. It is asserted that fully half of the Cobalt district is affected by the action taken and that the property could be easily sold to-day for $10,000,000. The action is the result of representations made to the Government by miners and prospectors concerning holdings of Temiskaming and Hudson Bay Mining Co., Ltd., a company organized and incorporated during the final months of the Ross government. Under its charter it was empowered to locate 640 acres of land for purposes of development. It is alleged that not only was this allotment taken up, but that 11 men who constituted original shareholders also took up all claims possible, and that each then made a declaration of trust handing over these claims to the company and thus making a breach of the mining laws.

The Lake Superior Corporation's steel rail mill is now running at full capacity, there being a large number of orders ahead. It is stated that possibly this year arrangements will be made for the construction of a large coke plant and the installation of open-hearth furnaces.

BRITISH COLUMBIA.

Nelson.—While some inconvenience has resulted from the recent fire at the Ymir mine, operations both at the mine and mill have been carried on uninterruptedly. At the mine development is under way to the west of the main shaft on the 500, 600, 700 and 1,000 ft. levels, and it is reported that important new discoveries of ore are being made.

A new furnace described as the Blanchard, after its Seattle inventor, has been installed at the Pilot Bay smelter, the preliminary experiments on Blue Bell ore having given entire satisfaction.

It is expected that the new mill under construction at the La Plata mines will be in readiness to commence operations within the next two or three months. The mine is meanwhile shipping ore regularly to the Hall mine smelter, at the rate of about 10 carloads a month.

East Kootenay.—The St. Eugene Consolidated Mining Company, Limited, paid, during the month, a seventh dividend of 2 per cent. This company has now paid to date, in the form of dividends, $560,000.00. The mine and concentrating mill are now in active operation. About 90 tons of concentrates a day are being sent to the Canadian Smelting Works at Trail.

Cariboo.—In an interview with the Victoria *Times* Mr. H. Jones, M.P.P., Cariboo District, is reported to have stated that prospects at the present in that district are extremely encouraging, and that there is a likelihood of gradually increased activity in and about the Cariboo mines during the coming season, Hitherto the work done has been largely of a prospecting nature, but the big companies, after sinking to the necessary depths, are striking out for the deep channels where heavy deposits of gold are believed to exist. Already in some cases these tunnels or drifts extend underneath the Willow river, through a stratum of deposit about 100 feet thick between the present and the ancient bed of the river. The nature and extent of the preliminary work may be gathered from the fact that the minimum depth of shaft required for workings of this kind is 100 feet. There are at present about seven big companies working, in addition to numerous prospecting ventures, hydraulicing concerns and individual diggers, and the quantity of gold taken out, chiefly by the latter, amounted to some $350,000 in value during the past season. This return would have been largely increased but for the serious shortage of water consequent upon an exceptionally dry season.

It is reported that better pay has been struck at the Cariboo Consolidated *La Fontain* mine, gravel running 9 oz. and upwards to the sett.

Boundary.—The second furnace of the Dominion Copper Company's smelter at Boundary Falls was blown in during the month. Shipments from this company's mines have also been considerably increased.

The Boundary Iron Works, Limited has declared a first dividend of 5 per cent. payable on the 1st of March. It is stated that the business of this foundry has grown enormously during the last few months.

The strike of smelter employees of the B.C. Copper Company and the Dominion Copper Company, at the beginning of January was, fortunately, short lived, and as the result of conferences between the officials and the men the matter in dispute was amicably arranged on the basis of an 8 hour day. The men had asked to be paid the same rate for an 8 hour day as for one of 12 hours. However a new schedule was arrived at, by which the coke wheelers and charge wheelers are to receive $2.70 a day and tappers and pot dumpers $3.00.

Slocan.—The Kaslo *Kootenaian* remarks editorially that much adverse comment has been occasioned recently anent the excessive freight charges on zinc ores between Sandon and Kaslo. Some of the shippers maintain that hitherto the rate has been only $1 per ton to Kaslo and are much incensed over the new rate, claiming that the Great Northern in levying such charges are attempting to divert the ore to the United States smelters for the purpose of securing the long haul over their own lines. On the other hand the local railroad people deny this and further maintain that there never was a tariff rate of $1 per ton from Sandon to Kaslo. The rates have always been the same—$2.50 per ton—between Sandon and Nelson and all intermediate points. Mr. H. M. Adams, of the Freight Department staff of the Great Northern, meanwhile has stated that rates on ore on the K. & S. Road have never, to his knowledge, been advanced. The present rate of $2.50 per ton in carload lots to Pilot Bay and Nelson being the lowest rate that has ever been in effect.

Rossland.—A suitable plant has been purchased for use in operating the Copper Valley mine, situated on Big Sheep Creek, in the vicinity of Velvet-Portland. It is proposed to actively develop the property. It is reported by the Rossland *Miner* that the St. Paul mine, one of the early discoveries in the district and operated by a company, has been purchased by Mr. W. R. Brock, of Toronto, with the possible intention of re-organizing the original company and resuming work. The St. Paul claim is situated on the northern slope of Deer Park Mountain, immediately west of the White Bear.

Notice is given in the British Columbia *Gazette* of the incorporation of the White Bear Mining Co., Ltd., with a capital of one million dollars in shares of 10 cents each. The company is specially limited under section 56 of the companies act. The object of incorporation is to take over the property and business of the White Bear mine in this city and to acquire all the property and rights necessary to the operation thereof.

THE COAST.—The Government Agent at Texada Island reports that the Marble Bay Company last year shipped 12,000 tons of ore. The mine has been developed to a depth of 671 feet, the shaft having been deepened at 100 feet, in addition to which 340 feet of drifting was done and 200 feet of other development work. The company reports that the gold values in the ore have been maintained, and that the copper values have somewhat increased.

Operations were started at the Crofton smelter on the 4th of January, and a shipment of blister copper has already been made to New Jersey. The briquetting plant has been installed and the works are now in full running order and treating ore, not only from the company's own property at Howe Sound, but from Prince of Wales Island, and from Mullen, Idaho.

YUKON.

Dredging possibilities on the Hootalinqua have lately been attracting some attention, and it is learned that Boston capital has become interested in the exploitation of the field.

The Yukon *World*, in a recent article, refers to the success achieved by the individual miner on Barker Creek, situated 27 miles before Stewart Crossing. The creek, which has only recently been exploited, is 35 miles long, pay having been found 15 miles from the mouth. On the discovery claim the width of the stream is from 500 to 1,500 feet. It is stated that at present 25 men are working claims here and in some cases are earning from $8.00 to $10.00 a day. The ground is shallow, being from 14 to 16 feet deep, the gravel having a brownish color, similar to that given by iron stain. The benches in the vicinity are said to be most promising.

MINING MEN AND AFFAIRS.

Mr. S. F. Parrish, formerly manager of the Le Roi mine at Rossland, is now residing at La Jolla, California, where he has assumed the management of an important property.

Mr. John Y. Cole, of Rossland, who for the past 12 years has been engaged in mining in different Kootenay districts, has left British Columbia, and proposes establishing himself at Cobalt, Ont,

Mr. J. B. Tyrrell, the well known mining engineer of Dawson, Y.T., is spending the winter months in Ottawa, his address there being 266 McLaren Street.

A short but useful course on *mining instruction* has recently been provided by the University of the State of Washington, Seattle, lasting three months. The studies include geology, mineralogy, assaying, chemistry, mining and milling, and the mining laws of the United States, British Columbia and Alaska. No charge is made for tuition, except in the assaying and chemistry course.

Mr. S. S. Fowler, of Nelson, accompanied by Mrs. Fowler, is spending the winter months in California.

Mr. Paul S. Couldrey, manager of the Le Roi No. 2, recently at the request of the company examined the property of the Velvet-Portland Mines, Ltd., preliminary, it is conjectured, to the resumption of operations at these mines.

The CANADIAN MINING REVIEW has been informed by the secretary of the Exhibition branch of the Department of Agriculture that it has been awarded a diploma of the Gold Medal class for its exhibit at the St. Louis World's Fair, 1904.

Mr. M. Gintzberger, manager of the Monitor and Ajax Fraction mines at McGuigan, has had the misfortune to break a leg. We learn, however, that he is rapidly recovering from the accident.

We regret to record the death, which occurred recently, of Mr. E. J. Thain, who for some time past has acted as Government Mining Recorder at Atlin.

Dr. H. A. Young, M.P.P. for the Atlin District, in a recent interview stated that while a shortage of water last year necessarily reduced the production of the district, nevertheless thinks the yield will probably aggregate $600,000.00. He furthermore expressed the opinion that the development of the Windy Arm mines will have the beneficial effect of attracting more attention to mining in the northern territory. Dr. Young further stated that individual miners are still doing well in Atlin, the past season having been an exceptionally good one, so far as this class was concerned. At the present time about 300 men are engaged in drifting work, and the clean-ups will take place in the spring.

Mr. J. Obalski is to be congratulated on having been appointed Director of Mines for the Province of Quebec, and also Superintendent of Mines, with a corresponding increase of salary.

Mr. James Crease, manager of a gold mine at Mount Uniacke, N.S., was very near the victim of a murderous assault last month, having been shot at on his way to the property. Shortly before Mr. Crease had received anonymous letters warning him to leave the neighborhood or suffer the consequences, and notices had been posted in the district threatening the employees at this property to cease work. The matter is being investigated by the Nova Scotian authorities.

Mr. G. C. Bateman, who last year graduated from the Kingston School of Mining, has received an excellent appointment at Copper Cliff.

Mr. R. W. Brigstocke, Manager of the Drummond Mines, Ltd., Haileybury, was married last month to Miss Ioraine Leslie, of Kingston.

Mr. J. C. Drewry, one of the directors of the St. Eugene, and managing director of the Canadian Gold Fields syndicate, spent some days in Montreal last month. He speaks very hopefully of the immediate future of mining in British Columbia.

Mr. G. H. Duggan has been appointed second vice-president of the Dominion Coal Company.

We extend most hearty congratulations to Dr. F. D. Adams, Logan Professor of Geology, McGill University, who, in recognition of his notable services, established in connection with the science he represents, has been awarded by the Geological Society of London, the Lyell medal. This medal was also awarded in 1881 to Dr. Adams' distinguished predecessor, Sir Wm. Dawson.

We have received a communication from the Secretary of the Iron & Steel Institute, 28 Victoria Street, London, England, stating that a research scholarship or scholarships, of such value as may appear expedient to the council of the institute from time to time founded by Mr. Andrew Carnegie (Past-President), who has presented to the Iron and Steel Institute eighty-nine one-thousand dollar 5 per cent. debenture bonds for the purpose, will be awarded annually, irrespective of sex or nationality, on the recommendation of the council of the institute. Candidates who must be under thirty-five years of age, must apply on a special form before the end of February to the secretary of the institute.

The object of this scheme of scholarships is not to facilitate ordinary collegiate studies, but to enable students, who have passed through a college curriculum or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects, with the view of aiding its advance or its application to industry. There is no restriction as to the place of research which may be selected, whether university, technical school, or works, provided it be properly equipped for the prosecution of metallurgical investigations.

The appointment to a scholarship shall be for one year, but the council may at their discretion renew the scholarship for a further period instead of proceeding to a new election. The results of the research shall be communicated to the Iron and Steel Institute in the form of a paper to be submitted to the annual general meeting of members, and if the council consider the paper to be of sufficient merit, the Andrew Carnegie gold medal shall be awarded to its author. Should the paper in any year not be of sufficient merit, the medal will not be awarded in that year.

COMPANY NOTES.

BRITISH COLUMBIA COPPER.—The annual general meeting of this company will be held in Charleston, W. Va., on Feb. 13th. The books were closed on Jan. 23rd, and will be re-opened on Feb. 17th.

TYEE COPPER COMPANY.—During December the smelter ran 11 days and treated 2,035 tons of Tyee ore giving a return after deduction of freight and refining charges, of $33,460.10

CROW'S NEST PASS COAL.—It is rumored that the directors of this company are contemplating proposing to the shareholders at the annual meeting next month the issue of bonds bearing interest of 5% in connection with a reorganization plan. It is not clear why this should be necessary.

LE ROI.—Shipments for last month amounted to 6925 tons, containing 2772 ounces of gold, 5300 ounces of silver, 205,700 pounds of copper. Estimated profit on this ore, after deducting cost of mining, smelting realization and depreciation, $32,500. Expenditure on development work during the month, $8,000.

MINING CORPORATIONS.

ONTARIO.

New York and Ontario Mining Company, Limited.—Capital $40,000.00, in shares of $100.00 each. Head Office, Toronto. Provisional Directors, Messrs. Geo. Reginald Geary, Fitzgerald Douglas Byers and Oscar Frederick Taylor.

The Dwyer Mining Company, Ltd.—Capital, $100,000.00, in shares of $5.00 each. Head Office, Toronto. Provisional

Directors, Messrs. John Brush LeRoy, Daniel Robert Dwyer and John Russell Humphreys.

Vermilion River Iron Ore Company, Limited.—Capital, $80,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors, Messrs. Frank Denton, John Walter McDonald and Ella A. Francis.

Wendigo Progressive Mining & Development Company, Ltd.—Capital, $40,000.00, in shares of $1.00 each. Head Office, New Liskeard, Ont. Provisional Directors, Messrs. John Cox, Samuel Drew Eplett, Geo. Wm. Slade, John Wesley Foreman and John McFarlane.

Dymond Development Company, Ltd.—Capital, $250,000, in shares of $100.00 each. Head Office, Ottawa. Provisional Directors, Messrs. Chas. Wilson Farran Gorrell, Adam Tozeland Shillington, Bion Joseph Arnold, Wayland Lloyd Arnold and Ralph Glenroy Arnold.

Northern Ontario Copper Company, Ltd.—Capital, $500,000.00 in shares of $1.00 each. Head Office, Sault Ste. Marie. Provisional Directors, Messrs. John Angus Montague, Ozias Byron Jury, Uriah McFadden, Wimmiam Edwin Gimby and Arthur Cyril Boyce.

Croesus Mining Company, Limited.—Capital $500,000.00, in shares of $100.00 each. Head Office, Ottawa. Provisional Directors, Messrs. Shirley Ogilvie, Douglas L. McGibbon and Travers Lewis.

Clarks Standard Developing Co., Limited.—Capital $40,000.00, in shares of $1.00 each. Head Office, New Liskeard. Provisional Directors, Messrs. John Jeffery Grills, Thos. Clark, Robert B. Herron, William Votier Cragg and James Leitch Brown.

Canadian Cobalt and Silver Mining Company, Limited.—Capital, $250,000.00, in shares of $1.00 each. Head Office, Ottawa. Provisional Directors, Messrs. Thos. Birkett, Alphonse Antoine Taillon, Thomas Lindsay, Herman Humphrey Lang, William Drummond Hogg, Wm. Frederick Powell, Douglas Macnair and Robert Taylor Shillington.

Abitibi Mining & Developing Company, Ltd.—Capital $100,000.00, in shares of $1.00 each. Head Office, Finch, Ont. Provisional Directors, Eathen Henry Marcellus, John McLaughlin, Jno. J. McMillan, James Currie, Colin Smith Nesbitt, Herbert Eardley Bingham, Duncan Alexander McNaughton.

The Terrill Cobalt Mining Co., Limited.—Capital $100,000.00, in shares of $1.00 each. Head Office, Sault Ste. Marie. Provisional Directors, William Edwin Gimby, Geo. Woolrich, David Irvine Millar, Henry H. Taylor, Wesley Burns Moorehouse, Alexander McIntyre, Frederick Rogers, Abraham Geo. Terrill and Robert Henry Schultz.

Empire Construction Company, Limited.—Capital $1,000,000.00, in shares of $100.00 each. Head Office, Montreal. Provisional Directors, Vicomte Louis Charliers de Buisseret, gentleman; Eugene Fichefet, contractor; Baron Constant Goffinet, minister plenipotentiary; Louis Goffin, engineer; Louis Grenier, engineer; Gerard Macquet, engineer; C omte John d'Oultremont, (Grand Marechal de la Cour), Armand Rouffart engineer; Edmond Rouffart, doctor of medicine, all of Brussels, Belgium, except Louis Grenier, who resides at Ghent, Belgium, and Louis Charliers de Buisseret, who resides at Seneffe, Belgium; James B. Tudhope, Orillia, Ont.; Henry W. Fleury, Aurora, Ont.; Paul Galibert, merchant, and Thomas Gauthier, accountant, both of Montreal.

Canadian Consolidated Mines, Limited.—Capital $5,500,000.00, in shares of $100.00 each. Head Office, Toronto. Provisional Directors, Messrs. Henry Smith Osler, barrister-at-law; William Beardsley Raymond, barrister-at-law, Frank Ford, barrister-at-law; Geo. Chas. Loveys Loveys, accountant, William Wellington Livingston, student-at-law; James Miller Ewing, accountant, and Britton Osler, solicitor, all of Toronto ,Ont.

The Abittibi Mining Company, Ltd.—Capital, $10,000.00. in shares of $100.00 each. Head Office, Montreal.

Temagami Silver Mining Company, Ltd.—Capital $150,000.00, in shares of $1.00 each. Head Office, Sturgeon Falls, Ont. Provisional Directors, Messrs. Geo. Gordon, Jesse Bradford, Alex. Burton Gordon, Thos. Urquhart, Jeremiah Daniel Cockburn, Chauncey Thos. Kirby and Geo. Phillip Cockburn.

BRITISH COLUMBIA.

Crescent Mines, Ltd.—Capital, $1,000,000.00 in shares of $1.00 each.

White Bear Mining Company, Limited.—Capital, $1,000,000.00, in shares of 10 cents each.

The Norma Mines, Limited.—Capital $300,000.00, in shares of $1.00 each.

NOVA SCOTIA MINING INTELLIGENCE.

(From Our Own Correspondent.)

During the month of January 385 gold mining areas were taken up under prospecting license in the different districts, the larger quantity being areas that had expired and had been re-applied for.

The following is a statement of the numbers of areas applied for and district:—

	Areas
Oldham	48
Meteghan	30
Cow Bay	6
Chezzettcook	16
Renfrew	9
Montague	48
Antrim	6
Millers Lake	22
Stormont	13
Fifteen Mile Stream	89
Scraggy Lake	11
Malaga Barrens	6
Lochaber	39
Wagamatkook	14
Whiteburn	2
Gold River	12
Beaver Dam	10
Harrigan Cove	4
Total	385

The latest mill returns to hand, give tonnage and yield as follows:—Frederick Taylor mill, Oldham, during Oct., Nov. and Dec., 1905 crushed 531 tons, which yielded 547 oz. 0 dwt. 0 grs.

At the Philadelphia mill, North Brookfield, 350 tons crushed in November yielded 142 oz. 15 dwt. 0 grs. and in December 162¾ tons crushed yielded 75 oz. 15 dwt. 0 grs. gold.

In the Stormont district the McCawley mill crushed 397 tons during Oct., Nov., and Dec. and the yield of gold therefrom was 370 oz. 10 dwt. 0 grs. and in same district 392 tons were crushed at the MacKeen mill and yielded 165 oz. 18 dwt. 20 grs. gold.

At the J. A. Crease mill Mount Uniacke 35 tons were crushed during Dec. which yielded 71 oz. 5 dwt. 0 grs

LAST YEAR'S PRODUCTION OF PIG IRON.

During the year 1905 a considerable advance was made in iron and steel output in nearly all the producing countries. This is shown by the following comparative table giving the production of pig iron in the respective countries in thousands of tons:—

	1905	1904
United States	23,000	16,497
Germany	11,000	10,058
Great Britain	9,500	8,563
Belgium	1,400	1,283
France	3,200	3,000
Russia	3,500	2,978
Austria Hungary	1,500	1,480
Sweden	600	529
Canada	420	295
Other countries	600	500
Totals	54,720	45,183

It is probable that this is the greatest advance of pig-iron output hitherto attained in any one year.

MINING SHARE MARKET.

The market for mining shares has been more active during the month than for a long time past.

The consolidation of the Centre Star and other properties in British Columbia, has been favorably received, and all the floating stock of it and the St. Eugene has been quietly absorbed.

The Canadian Gold Fields Syndicate is firm on the satisfactory reports presented at the annual meeting. There is a considerable demand for many of the low-priced Rossland properties, on the belief that the smelter charges in the future will be so reduced as to enable many of the properties that are now closed down, to produce ore at a profit.

In the Industrials there has been a fair amount of business done and prices are buoyant on the increased earnings of the various companies, due to the improved business conditions.

The following list shows the quotations for the week ending

February 8th, as supplied to the REVIEW by Robert Meredith & Co., 57 St. Francois Xavier St., Montreal:—

Par value of shares.		Asked.	Bid.
.10	Canadian Gold Fields Syndicate	.06	.05½
5.00	Cariboo Hydraulic	——	——
1.00	Centre Star	.40	.35
1.00	Deer Trail Consolidated	.02	——
1.00	Giant	.02½	——
10.00	Granby Consolidated	10.25	10.00
10.00	Montreal and Boston	½	⅜
1.00	North Star	——	.04
1.00	Payne	.02	——
1.00	Rambler Cariboo	.35	——
1.00	Monte Christo	.03½	.02½
1.00	St. Eugene	.68	.65
1.00	White Bear	.02½	——
100.00	Nova Scotia Steel (common)	.73	.72
100.00	Nova Scotia Steel (preferred)	122.00	118.00
100.00	Dominion Coal (common)	.81½	.81¼
100.00	Dominion Coal (preferred)	122.00½	120.00
100.00	Dominion Iron and Steel (common)	.32	.31
100.00	Dominion Iron and Steel (preferred)	.79½	.78½
—	Dominion Iron and Steel (bonds)	.85	.84

INDUSTRIAL NOTES.

Bulletin No. 10 is a very handsome descriptive pamphlet, printed in two colors, and issued by the Jeffrey Mfg. Company, Columbus, Ohio. It contains upwards of 60 pages of illustrated matter dealing with the well known Jeffrey electric mine locomotives, and will well repay perusal.

The David Maydole Hammer Company, Norwich, N.Y. sent us an illustrated catalogue describing hammers manufactured by them, which now comprise 343 styles, sizes and finishes.

The Allis-Chalmers-Bullock, Ltd. are distributing among their clients and others, a very handsomely printed monthly calendar, in gold and colors. These cards are not only useful but ornamental, and make an acceptable gift.

The Abner Doble Company, represented in Canada by the John McDougall Iron Works Company, Ltd., in Montreal, send us a copy of Bulletin No. 7, devoted to the Doble Tangential Water Wheel. In addition to the usual information, this catalogue contains data sheet for estimates, which should greatly facilitate ordering.

B. Greening Wire Company have just issued an interesting pamphlet on Wire Bonding for Concrete Construction. This is a subject in which many of our readers are interested, and they will therefore be glad to have the pamphlet in question, which very fully covers the subject.

Extensive additions to the works of the Canadian Rand Drill Company at Sherbrooke Que., will shortly be undertaken. A new foundry, it is understood, is among the improvements to be carried through.

The Sullivan Machinery Company are good enough to send us the following cutting from the Cripple Creek *Times*, which may be of interest to some of our readers:—

An interesting feature of mining in the Cripple Creek district, and an item which is as closely watched by the operator as any other, is the cost of making air per drill shift, upon which largely depends the possibilities of economical operation. The wide range in this one respect is shown by the fact that in some instances the cost is as high as $3 per drill shift, while in others the same results are obtained at a cost of 53 cents. This great difference is due to the class of machinery used and the care and intelligence with which it is operated. Of the different records obtained from mine operators the following seems to show the greatest economy:

Mr. John Sharp, the well known lessee who [illegible] operating the Morning Glory of the Work and the Colorado B[illegible]s of the Cripple Creek Consolidated Company, furnished data covering a period from September 20, 1904, to January 17, 1905 during which time 1,367 drill shifts were operated. As shown by his books, during that time the coal bills amounted to $1.183.17. The greatest number of shifts worked in one month was in October when 492 were employed.

The rock hoisted amounted to 7,500 tons during the months of October, November and December, and the coal bills for hoisting amounted to $450, leaving the total coal bill for running the air compressor $733.17, or 53.7 cents per drill shift.

It is doubted if this record can be duplicated in the district. In speaking of his accomplishment in economical operation Mr. Sharp said: "I think that my record for making air per drill shift is about as low as it can be made. My cost was 53.7 cents per drill shift for coal. The machine used was a straight-line compressor with simple steam and compound air cylinders, and was built by the Sullivan Machinery Company of Chicago. It is supposed to operate only ten drills, but often exceeded the rated capacity. In my opinion it is as economical a compressor as can be constructed, and certainly the tests I gave the machine under all conditions, are sufficient to demonstrate this fact."

The Sullivan Machinery Company of Chicago, reports the appointment of Mr. H. T. Walsh, as manager for the Pacific Coast, with headquarters with the well-known firm of Henshaw, Bulkley & Co., at San Francisco. Mr. Walsh has had an extended experience with mining equipment having represented the Sullivan Machinery Co. in the Rocky mountain region for a number of years. Henshaw, Bulkley & Co. who have been for a long time the agents of the Sullivan Machinery Co. will continue to carry a stock of Sullivan rock drills and compressors.

The Golden Key Mining Co., Hillside, Ariz., is installing a power plant to operate its machinery. Contract has been closed for two of the well-known "Hornsby-Akroyd" oil engines, 16 horse power each, built by the De La Vergne Machine Company of New York.

The American Steel Dredge Works, Logansport, Indiana, which was organized by Messrs. James P. Karr and John D. Rauch; now have their complete plant in operation.

An important order recently secured by the Canadian Westinghouse Company was obtained from the Vancouver Power Company, of Vancouver, B.C. This order included a 1500 H.P., 2200 volt revolving field engine type generator, which will be direct connected to a Pelton water wheel. This is a duplicate of the generators now in operation in the power plant of this company and will operate in multiple therewith. The order includes switch boards, air blast transformers of 550 K.W. capacity. There is also included in the order a 1000 K.W. 60 cycle rotary converter to operate 550 volts. This converter will furnish power for railway work and will be controlled direct from the switchboard.

A conspicuous departure in the lighting of canals is that of the Welland canal near St. Catharine, Ontario. Over 600 A.C. series arc lamps have been provided by the Canadian Westinghouse Company and these have been in operation for the past few months and have given splendid service. This installation as a whole redounds great credit to the Ontario government, as well as the consulting engineer, Mr. R. J. Parker, under whose direction the complete plant was installed.

There is every indication of the reawakening of the mining industry in the northwestern part of Ontario. The Northern Development Co. for example, which has being doing hand work for several years in the Rainy River district is now preparing to operate on an extensive scale, and recently purchased from Allis-Chalmers-Bullock, Limited, Montreal a complete mining plant including boilers, air compressors, rock drills, hoisting engine, pump and a large quantity of miscellaneous mining equipment.

MINING AND METALLURGICAL PATENTS.

(Specially reported for the CANADIAN MINING REVIEW).

806,173—Electric Furnace. Romaine M. Meyers, Fruitvale, Cal.

An electric furnace having a plurality of pyro-electrolytic bars within a heat resisting shell, means of protecting the substance to be heated and the said bars during the insertion and withdrawal of said substance, consisting of the heat-resisting rods arranged in parallel with said bars, between said bars and the space occupied by said substance.

805,414—Metal Separator for Ore-Concentrating Plants. Henry C. Krause, Point Mills, Michigan.

The combination of a hopper having a funnel-shaped partition which terminates at the bottom in a contracted discharge-opening between the top and bottom of the hopper and forms with the lower part of the hopper a receptacle for metal and heavy concentrates passing through said discharge-opening when the opening at the lower end of the hopper is closed, and a trap connected with the lower part of said hopper and provided at its upper and lower ends with valves and a water-supply connection leading into said hopper between said partition and the upper valves.

806,621—Copper Refining Furnace. Ralph Baggaley, Pittsburg, Pa.

The combination of thick metal walls built up of comparatively narrow segments, a relatively thin refractory lining, a solid removable metal top, of sufficient thickness to withstand and to conserve the internal heat, means for supplying auxiliary heat above the level of the bath, means for introducing precreated hydrocarbon gas below the level of the bath, means for regulating the escape of hot gases, and means for tipping the vessel either to receive or to pour the charge.

807,973—Process of Obtaining Marketable Electrolytic Deposits. Pierre Steenlet, Brussels, Belgium, assignor to Marcel Perrew Lloyd, Brussels, Belgium.
A process which consists in charging the diaphragm with an organic substance, treating said organic substance to render it insoluble interposing the thus-charged diaphragm between a metallic-anode and the cathode and the corresponding portions of an electrolyte containing a metal, and causing an electric current to flow from the anode to the cathode through the thus-charged diaphragm and form a metallic deposit on the cathode.

806,121—Zinc Furnace. Emile Dor-Dellatre, Budel, Netherlands.
In a gas-heated zinc furnace, the combination with a furnace-chamber, of air and gas channels adapted to communicate with the chamber through a common passage, adjustable means for regulating the admission of air and gas to said common passage, and means within the chamber in alinement with said passage to deflect laterally the currents entering the chamber through said passage.

807,271—Process of Extracting Metals from their Sulfids. Antonine H. Imbert, Grand-Montrouge, France.
The process for extracting from its sulfid, a metal having less affinity for sulfur than is possessed by copper, consisting in mixing the sulfid of such metal with the amount of copper only sufficient to combine with the whole of the sulfur, in heating this mixture to a temperature suitable for the reaction for forming copper sulfid and liberating the other metal, and collecting this liberated metal and the copper sulfid separately.

807,016—Conveyor. Joseph H. Burns, Cleveland, Ohio.
A conveyor comprising two parallel chains arranged side by side and a suitable distance apart laterally and aprons spaced longitudinally of the chains and attached at their forward ends only and removably to the chains, which aprons are detached by pressing the chains toward each other at the forward ends of the aprons.

806,774—Process of Treating Ores. Horace F. Brown, Oakland, Cal.
A process which consists in reducing the same while in atmospheric suspension and during such suspension causing the reduced particles to agglomerate into clinker, the bodning of the ore being caused by the resultant spongy condition thereof.

807,071—Gas Producer. Bruno Graupe, Colgnoe, Deutz, Germany.
In a gas producer with top and bottom combustion zones and intermediate means for the withdrawal of the gas, a substantially vertical grating composed of vertically-extending grate-bars forming part of the producer-walls through which the gases are led off.

806,894—Calcining Furnace—George N. Jepson, Worcester, Mass.
A down-draft calcining-furnace comprising a heating-chamber, a fire-box, flues connecting the fire-box with the upper portion of said chamber and flues at the lower portion of said chamber for carrying away the products of combustion, a series of tubes within said chamber and extending through the walls thereof, and collars fitted within the walls of said chamber and loosely surrounding said tubes whereby the tubes are permitted to expand longitudinally.

807,594—Gas Producer. William H. Bradley, Bellevue, Pa., assignor of one-fourth to Alexander Gilliland and one-fourth to William C. Bradley, Bellevue, Pa. and one-eighth to Sara L. Bradley and one-eighth to Mrs. M. E. Webster, St. Louis, Mo.
A gas-producer having a water-trough, a cross-inclined wall and a wind-pipe above said wall and transverse thereto, said wind-pipe having clearance-spaces on both sides thereof for the removal of ashes.

807,661—Ore Concentrator. Walter S. Craven and George W. Craven, Butte, Mont.
An ore concentrator having an inclined feed-table, means whereby water is supplied thereto in only sufficient quantity to insure the flow of ore and to flow with the latter, a trough at and extending beyond the lower end of the table, the edge of the trough farthest from the table on the same plane as the table, and the edge of the other side under and separate from the lower edge of the table, a partition extending from the table to near the bottom of the trough, and means for agitating the material in the trough.

806,103—Conveyor. Paul Burchardt, Kramfors, Sweden.
The combination with a chute, having a bottom and longitudinal ribs located within said chute and near the bottom thereof, of a belt consisting of a plurality of flat sheet-metal plates hinged together, said belt being movable longitudinally within said chute and bearing on said longitudinal ribs.

807,118—Apparatus for Drawing Coke-ovens. Isaac C. Kelly, Scottdale, Pa.
The combination of tongs constructed to grasp the coke and hold the same, a carrier for said tongs arranged to alternately project the same into and draw the same out of the oven, and automatically operating mechanism for opening and closing said tongs.

807,501—Process of Concentrating Ores. Alfred Schwarz, New York, N.Y., assignor to Schwarz Ore Treating Company, Phœnix, Ariz., a corporation of Arizona.
A method which consists in subjecting a non-sulfid ore to the action of a soluble sulfid to convert the mineral into a sulfid, then treating the mass with a hydrocarbon and finally separating the hydrocarbon with the entrapped metallic constituents of the ore from the tailings.

808,293—Roasting Furnace. Frank E. Marcy, Chicago, Ill.
In a furnace, a hollow rabble-shaft, a pipe having an inlet branch confined within the shaft for conveying a cooling medium through the shaft in one direction, and a return branch within the shaft coupled to, or forming a continuation of said inlet branch, for conveying the cooling medium in the opposite direction.

808,488—Combined Apparatus for Grinding or Crushing, Washing and Separating Ores. Reginald Stanley, Nuneaton, England.
An apparatus for treatment of ores, comprising rolls between which the material is reduced to a coarsely-ground condition, finishing-rolls adapted to allow only a thin layer of material to pass between them, a traveling belt of gauze underneath the finishing-roll to catch the material falling therefrom, means of any kind for forcing the crushed material through the gauze into a trough below the same, means for redistributing the material that cannot pass through the gauze to the finishing-rolls for regrinding.

808,141—Method of Making Lead Hydrate. George D. Coleman, Boston, Mass.
A method of continuously making lead hydrate which consists in introducing comminuted metallic lead, water and a limited quantity of an oxidizing reagent into a closed vessel, subjecting the contents to attrition and mixing and continuously drawing off the product with some of the water.

808,361—Process of Roasting Ores. Herbert Haas, San Francisco, Cal.
A process which consists of bringing them to a point of ignition, and supplying a light blast of air evenly distributed throughout the whole mass for the purpose of maintaining combustion thereof, and creating a sintered agglomeration, said blast being sufficiently light, and being continued for a sufficient time, to drive off and oxidize only the more easily-separable molecules of sulfur, or other metalloids, maintaining the heat below the smelting-point, and then increasing the blast to separate from the residue the less easily separable molecules of sulfur, continuing to increase the blast as required for the complete separation of the sulfur and then decreasing the blast in proportion to the amount of air decreasingly required to combine with the residual sulfur or other metalloids.

808,741—Coke Handling Apparatus. George G. Fryer, Syracuse, N.Y.
The combination in a coke-handling apparatus with a coke-oven; of a device for discharging the body of coke from the oven, and a platform for receiving the body of coke, said platform being movable on an axis arranged in a plane at an angle to the path of the body of coke during the passage of said coke through the ovens.

808,754—Method of Applying Heat for the Treatment of Ores and Metalliferous Sands. William J. Jackson, San Francisco, Cal.
A method which consists in adding to said ores or metalliferous sands a suitable exothermic material capable of developing heat when the aqueous solution of the extracting reagent is applied thereto.

809,085—Electrolytic Apparatus. Henry S. Blackmore, Mount Vernon, N.Y.

An apparatus comprising an electrolytic vessel having a means for producing a heavy and light metal alloy by the electrolysis of the light-metal compounds, in combination with means for displacing the heavy and light metal alloy by gravity, means for associating the heavy and light metal alloy with a metal hydroxid, means for removing the light-metal oxid thus produced, means for converting the light-metal oxid into light-metal hydroxid, and means for returning a portion of the light-metal hydroxid to the chamber containing the heavy and light metal alloy.

808,798—Apparatus for the Agitation of Solutions used in Electrodeposition of Metals. William C. Wood and Bertie Oaksford, London, England, assignor to W. Canning & Co., Birmingham, England.

In an apparatus for the electrodeposition of metals, the combination with the tank for containing the electrolyte of a trough arranged within the same, the said trough having within it a plunger designed for drawing the electrolyte into the trough and ejecting it therefrom.

808,618—Method of Converting Matte. Charles M. Allen, Lolo Mont., assignor to Ralph Baggaley, Pittsburg, Pa.

A method which consists in bessemerizing it is a vessel having a non-silicious interior, and thereafter transferring it into an acid-lined vessel and bessemerizing it.

PROVINCE OF NOVA SCOTIA.

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GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills, who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles transfers, etc., of minerals are registered by the Mines Department for a nominal fee and provision is made for lessees and licensees whereby they can acquire promptly, either by arrangement with the owner or by arbitration all lands required for thier mining works.

The Government as a security for the payment of royalties. makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous condition under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron. five cents on every ton; Tin and Precious Stones, five per cent.; Coal, 10 cents on every ton sold.

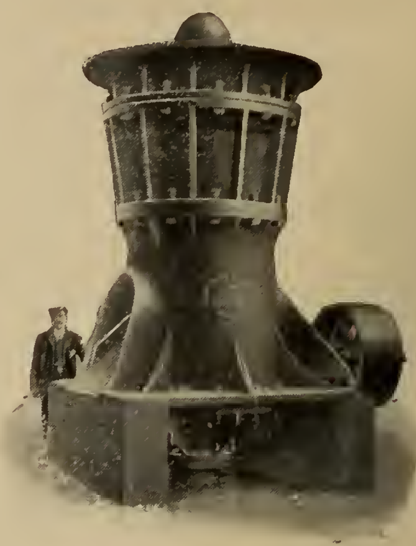
The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester Pictou, and Antigonish, and at numerous points in the Island of Cape Breton The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

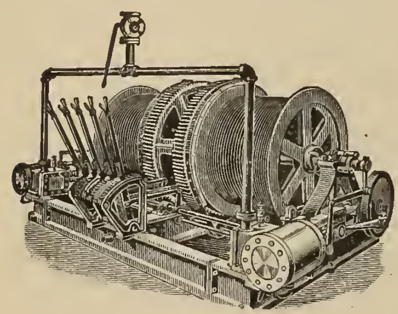
Copies of the Mining Law and any information can be had on application to

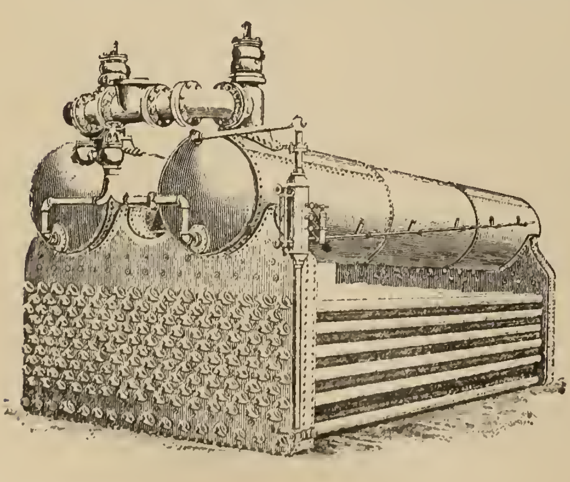
THE HON. W. T. PIPES,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.







THE

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ESTABLISHED 1882.

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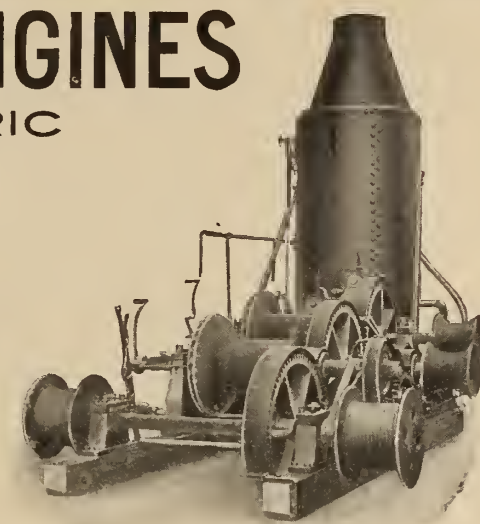

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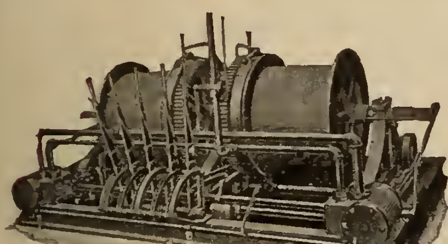

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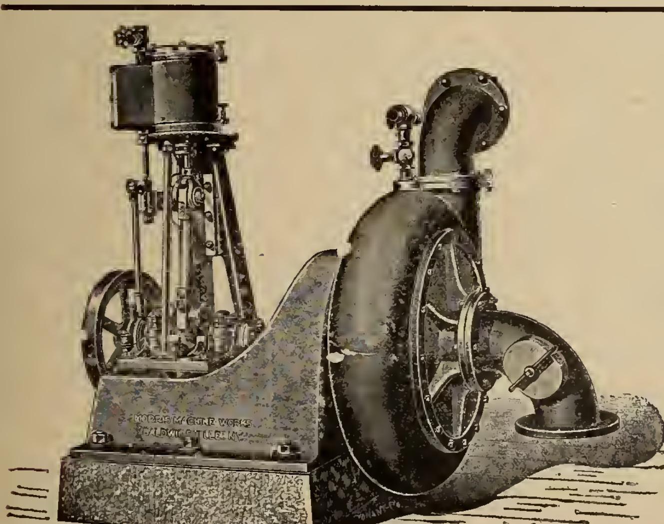

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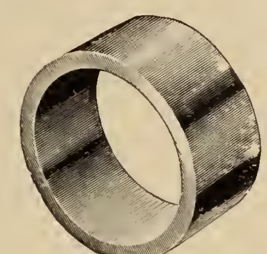

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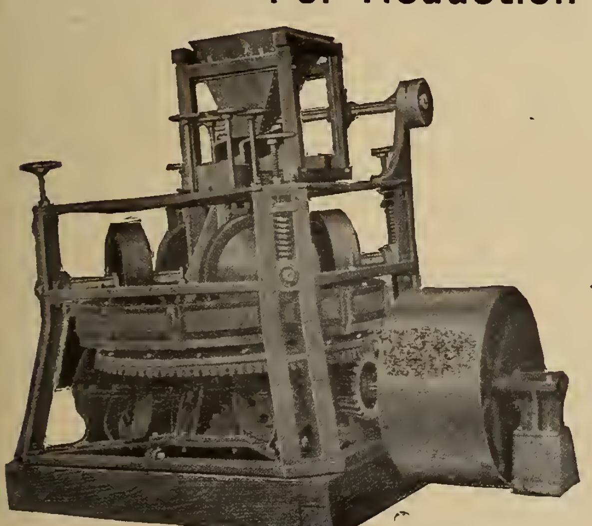

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24th YEAR OF PUBLICATION

The Canadian Mining Review

Established 1882

THE OLDEST AND ONLY OFFICIAL MINING JOURNAL PUBLISHED IN CANADA.

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Advertising copy must reach the REVIEW OFFICE ***not later than the 25th of the month*** preceding publication to secure insertion in next issue.

Advertising rates on application.

CONTENTS.

The REVIEW'S editor, Mr. H. Mortimer Lamb, has been ill with typhoid fever, from which he is now recovering. Our readers are therefore requested to overlook any shortcomings in this present issue, which has been without the valuable advice and oversight of Mr. Lamb.

The official stamp of a town has been given to Cobalt by the establishment there of one of the brightest weekly papers we have knowledge of. The new paper is a weekly of eight pages, of which two are devoted to matters in and about Cobalt and Coleman Township. The editor has a trenchant pen and a sound knowledge of good citizenship; under such a helmsman the *Free Press* should make port on every voyage. The REVIEW extends its greetings and best wishes to the new-comer.

"The Silver Leaf Mining Company's property has changed hands, having been bought by an American Company. The purchase price was $210,000. There was about $4000 expended on this property in prospecting and development. For an expenditure of four thousand dollars, the former company clears the handsome profit of $206,000. Big interest on that investment. The property is situated near Kerr Lake." The above from the Cobalt Free Press. The property alluded to is under an agreement to sell, but the $210,000 must be obtained from the pockets of the people. This is the property stocked by Douglas Lacey & Co. for the modest sum of $5,000,000.

The specific allotment of shares in the new organization known as the Canadian Consolidated Mines Limited, is reported as follows:—

For the entire assets of the St. Eugene Consolidated Mining Co., Ltd.	$2,333,300.00
For the Centre Star and War Eagle combined	1,555,500.00
For the Trail Smelter	750,000.00
For the Rossland Power Company	60,000.00
making a total of	$4,698,800.00

out of $5,500,000.00 total capital. The balance of the capital stock, namely: $801,200.00, will be retained in the treasury for the purpose of meeting such new expenses as may have to be charged against capital, and not against earnings.

A recent interview with Mr. J. B. Tyrrell, formerly of the Canadian Geological Survey and recently of Dawson, has been printed, in which Mr. Tyrrell finds considerable fault with the high transportation charges made by the White Pass Railway. Mr. Tyrrell entertains the idea that the Dominion Government should make an exploration of the country lying between the heart of the Yukon and some point on the Grand Trunk Pacific line in British Columbia. He is also of the opinion that the country through which this thousand miles of railroad will have to go is as promising as the region in New Ontario through which the Temiskaming road runs, and therefore that it would be a good investment on the part of the Dominion Government to make the preparatory explorations. Mr. Tyrrell is authority for the statement that some prices have gone down very considerably in Dawson City, but the funny part is that one pays as much for a newspaper as he does for a glass of whiskey.

The *Free Press*, published at Cobalt is looking after the interests of that town in many ways. Apropos of the beautiful chaos of lanes and alley ways which that town presents it comments as follows:—

"Would it be possible for the Railway Commissioners to break through their wilderness of mal-administration, and look after the building sites in Cobalt. Buildings are going up in all directions, principally in the west end of the town, and people who have nothing else to go by, but their own convenience, are building on the street and off it; and later on there will be endless confusion and litigation. It is to be presumed that the Railway Commission is not for ornament only, or for posing before Ontario as great financiers. Somebody should stick a pin in the Commission and see if it is alive."

We are informed that the Hon. Mr. Prevost, Minister of Mines for Quebec, is to personally visit the Chibogamoo mining district during the early summer, in company with the Superintendent of Mines, Mr. Obalski, and with a Belgian engineer, to advise the Honorable Minister as to the character and value of the new mining district. With all respect we venture to warn the Honorable Minister against relying too closely upon the opinions of qualified engineers who are unfamiliar with a country. The metalliferous rocks the world over have certain identical characteristics, but also they have very diversified forms in different regions, and as Canada has as good and capable geologists as can be found anywhere in the world, it would seem that to ignore these men by the importation of new men may unwittingly give a black eye to the new region.

On the 12th of February an official announcement was made of the reduction of rates for freight and treatment on silver-lead ores. The charge of $15.00 a ton, which had been in force since 1900, has now been cut to $12.00 a ton. This announcement was first made by the Hall Mining & Smelting Company, but it is understood that the reduction will hold good at the Trail smelter, at the Pilot Bay works, and at the Marysville smelter also.

No reason is given for this reduction, unless it is the one which is surmised generally by people well acquainted with the condition of ore supplies in British Columbia, and that is, that ore is wanted badly by the smelters and is not coming out in sufficient quantity to keep all the stacks in blast. Among other reasons given by the local press are: the adoption at the Hall smelter of labour-saving devices and increased economy in handling the ore and the adoption of the Huntingdon-Heberlein process which effects a reduction of the cost of roasting. To our mind the reduction of the treatment rate will probably have the effect of increasing ore supplies from the Slocan district, in which many deposits of comparatively low grade ore have not been worked for some years because the margin of profit was too small to permit of successful operation. The increased margin of $3.00 may allow certain of these properties to resume operations.

In connection with papers and discussions which were held at this month's meeting of the Canadian Mining Institute on the topic of a Federal Department of Mines and the work of the Geological Survey, it is apropos to mention that Mr. Chas. D. Walcott, Director of the United States Geological Survey has issued an order to all members of his Survey Staff which we reproduce below.

The occasion for this order arose from an attempt made recently by some members of the U. S. G. S. to control a mining paper in Chicago and to make use of the members of that Department of the Government. The affair was short-lived, and the instructions issued by Director Walcott were sensible and appropriate, except for the half a dozen publications which may be classed as "pure science" journals. On this point several of our esteemed contemporaries hold divergeịn views.

The following is the order sent by the Director to the members of the United States Geological Survey:

"Since the organization of the Geological Survey it has been the policy of the Director not only to permit, but to encourage its members to publish in technical and scientific journals and in the transactions of societies technical and scientific articles, provided they do not anticipate the official publication of the results of specific investigations, of which the priority of publication rests with the Geological Survey. It has always been believed that the widest dissemination possible should be given by this means to information in the possession of the Survey, particularly where the material to be published consists of information gained or conclusions reached as a result of general reading or observation, and is not the outcome of specific official investigations. Even if the writers receive compensation for such articles there does not appear to be anything objectionable in the practice, provided the writing is done outside of official hours.

When such articles are based on information that has been obtained in specific investigations, but (a) is contained in official reports already published or in press, or (b) is not considered appropriate for incorporation in an official report, permission to publish should be obtained from the Director, and the fact should be stated in the article.

There does, however, appear to be some question in respect to the propriety of Survey officials being identified as editors or special contributors, or in any other intimate way, with technical or trade papers conducted as business enterprises. Such connection is apt to be used for advertising purposes and is calculated to bring criticism on the Survey organization. It is deemed best, therefore, while not abridging any of the privileges recognized in the preceding paragraphs, to prohibit such connection of Survey officials with the conduct of trade papers.

This prohibition is not intended to apply to connection with journals which are devoted entirely to the dissemination of scientific knowledge and which are not conducted for profit or as business enterprises. Such publications are *Science*, the *National Geographic Magazine*, the *American Chemical Journal*, *Economic Geology*, *Forestry and Irrigation*."

That the district of Cobalt is to undergo the usual speculative phase, and the agony of joint stock companies founded on little or nothing but capitalized at seven figures, is now beyond doubt. The sale of the Silver Leaf property at the foot of Kerr Lake and its incorporation by the New York firm of Douglas, Lacey & Co., who for years have been known as the largest organizers of stock companies from which no returns have come to shareholders, is the first movement, and one which we fear will be but too common during the present year. The district, and the towns in it, are all preparing for this influx of stock jobbers and promoters, and undoubtedly the Toronto Stock Market will have a plentiful list of Cobalt Mines, with whose shares the general public will be invited to play the game of "buying and selling". We had hoped that mining in the Cobalt district, which has hitherto been conducted on a legitimate basis, was going to be free from the stock boom phase, but its richness and its newspaper fame has been too great to preserve it from a stock boom. We can only hope that the experience of the Canadian public with the Rossland and British Columbia fizzle of less than 10 years ago will keep them from seconding the efforts of the promoters to any extent.

In connection with this matter we reproduce for the benefit of our readers a choice editorial from that sturdy and independent sheet the *Free Press* of Cobalt. We congratulate our contemporary upon its attitude and wish "More power to its elbow."

"Wild cat" schemes do not come to Cobalt to operate. It is not healthy for them hre, but they use the name of Cobalt to give their schemes a gilt edge standing. Nearly everybody has heard that Cobalt is the richest mining district in the world, and the "wild cat" schemes are using the fame of the district to operate.

It looks such a simple matter to part the credulous and theif money. People who do not know much about mining, think that anything that is advertised as a claim in the Cobalt district is a safe investment and 'plunge'. A concern we believe is now operating in Michigan, on the strength of Cobalt's fame and selling one dollar shares for $45. The lot on which the stock is issued has been staked but nothing more. It is questionable if it has been passed by the inspector, but people are rushing in to get rich quick. "A fool and his money is easily parted" is an old saying that holds good in mining as in anything else.

Did the investor notice that none of these "wild cats" have an office in Cobalt? If their schemes were good for the investor, Cobalt would be the place for a head office, but that would not do, for the people here might expose it in defence of the reputation of the town.

Oh no! These fellows keep away from Cobalt but use the name of the town to dupe the unwary. It is so easy to fool some people. A lot on which there is nothing but building stone is advertised as a rich mine, and in order to show its wealth an assayer's certificate is published showing the assey in ounces to the ton. Now how is this managed? The assayer is a professional man. A specimen or sample is brought to him for an assay. He assays the samples, and gives a certificate as to its worth, and there his duty ends. He does not say in his certificate that he has taken the sample from the mine. He simply says he found so and so in the sample furnished, and how easy it is to get a sample. All the rich mines have plenty of ore on the dump and it is so easy to "swipe" a piece, and the assayers certificate does the rest. Then out comes a glittering prospector of the "immense wealth" of the quarry, published far and near and then the fakir site down and the money comes in.

The Free Press has been offered two of these advertisements but rejected them. The Free Press won't be made the agency for "doing" the people out of their money. We believe in honest dealing, and its not honest to dupe the credulous.

If any oily share shovers come at one of our readers, just tell him to wait. Then acquaint us with the location of the "immensely wealthy lot" and we'll do the rest.

If the scheme is a humbug, we'll tell it to you in capital letters and save you your coin. Don't you think it is perfectly absurd that any man would give you a dollar for twenty-five cents? Stop and think, and that's what the share shover tells you so glibly. Our advice to you is, don't be "a sucker". Dividend paying shares are not peddled around. They are kept for the family circle where the public are not invited. Don't be a "sucker".

With the quarterly dividend of $15.00 per share, payable on the 23rd of this month, the total amount paid to shareholders of the Calumet and Hecla Copper Mine will aggregate the enormous sum of $93,850,000. Beginning as a dividend payer in 1868, for 38 consecutive years the property has regularly paid a dividend averaging nearly 2½ millions of dollars a year on a total capital of $2,500,000 which capital represents an investment of $1,200,000 originally.

The Company easily stands at the head of the world's mining enterprises, no other mine has such a record either as to dividends or as to percentage upon original investment.

RESOURCES OF NORTHERN QUEBEC.

Our readers may remember that, in August we printed information concerning the resources of Northern Quebec which were then just beginning to attract the attention of capitalists and of mining men. Since midsummer the interest taken in the extensive area of mineral-bearing rocks in that section has been very great. Something over 230 square miles of the country bordering the northern and western shores of Lake Chibogamoo, surrounding Lake Wahkonichi, and including the communicating water ways, has been applied for under the existing mining laws of Quebec, and the Provincial Treasurer has received the money therefor. Transportation in this northern section has been helped and assisted by the Provincial Government to the extent of a grant of $10,000.00, for the purpose of opening a winter road into the district from the village of St. Felicien, and this road is being utilized at the present time by something over 100 men, sent in with supplies by half a dozen companies, for the purpose of prospecting their holdings for minerals during the coming summer.

The chief and parent organization of the whole is "The Chibogamoo Gold and Asbestos Mining Company, Ltd.," which was (as has been stated in a previous article) the direct outcome of the discoveries made by Mr. Peter McKenzie in the fall of 1903. From a modest beginning this corporation has become, at least on paper, a gigantic concern with a capital of $6,000,000.00; a very large amount of which is in cash, which has been put in by New York gentlemen interested, and believing, in the possibilities of the country. The difficulty of transporting men and supplies into that country, and of bringing out ore, or metallic products, from that section was clearly pointed out in the articles printed by the REVIEW last summer.

In full knowledge of these difficulties, applications have been made to the Provincial Government, at its present session of Parliament, for railway charters, not only into this particular Chibogamoo district but into that wide band of Huronian rocks which runs in a general easterly and westerly direction across the top of the province from Lake Chibogamoo to Lake Abitibi. What the possibilities of this large area of ancient and altered rocks are, in the way of valuable minerals, is entirely an unknown quantity as yet, with the exception of the eastern portion round Chibogamoo Lake. There, it has been well established that the greenstones are penetrated and altered by eruptives in many places, which eruptives seem, as in the Cobalt district, to have been the main cause of metallic precipitations in the rocks. The geological conditions for the existence of important bodies of metalliferous minerals seem to be present in most favorable form, and work, in the shape of development, is the only thing needed to demonstrate whether this Hinterland of Quebec is not one of the most important mineral areas that we have in the Dominion.

In other issues we have commented upon the energy and progressiveness of the present Minister of Mines, Colonization and Fisheries for the Province of Quebec, the Hon. Mr. Jean Prevost, who has endeavoured to organize his department upon business lines and administer it upon a sound basis. The difficulties which have confronted Mr. Prevost, as indeed every other official of the Government, have their origin in the financial poverty of the province; lack of money necessarily means lack of energetic administration, which is impossible when financial resources are small or crippled. It is probably for this reason that all applications for money grants for the projected railroads have been unceremoniously turned down, and the reason has been stated with delicious frankness and brevity. We are informed upon the best authority that colonization must precede any request for financial assistance to railroads in these new regions of the Province. There is, unfortunately, in this region north of the Height of Land little or nothing to tempt the colonizer. The district lying between Lake Abitibi and Lake Mistassini, in an easterly and westerly direction, and between the Height of Land and the 50th parallel of north latitude appears from all reports that have been made, to be good for nothing whatever unless it is a region rich in valuable deposits of mineral. The reasons for this are apparent; first, in its northern altitude, where early frosts and severe winters must be the rule at all altitudes greater than 400 to 500 feet above sea level; and secondly, to the stunted, or comparatively stunted, character of the timber which exists on the elevated plateaus. There would, therefore, seem to be the best of reasons for believing that any attempt to colonize this district north of the Height of Land, would be an expensive and probable failure; and that one must look solely to the development of the mining industry there for the creation of population and of small towns which would require the cultivation of such amounts of land as might be necessary to supply their inhabitants with the necessaries of life.

History shows us that all attempts to colonize remote interior sections have been failures unless such sections were covered by rich prairie loam. The experience of British Columbia may be taken as one example to bear out this statement; for many years, notwithstanding the mild and salubrious climate existing in that province, the rich valleys of British Columbia failed to attract settlers, simply for the reason that there was no local demand, nor market, for the product which these settlers might raise from the soil. With the discovery of Rossland in 1894, and the rapid development of South Eastern Kootenay, in the sections round Nelson, Boundary and the other main towns, there sprung into existence busy mining camps demanding food, and therefore creating a healthy local demand for farm products, which caused contiguous valleys to rapidly become peopled with colonists. Therefore, the rapid colonization in the interior of British Columbia is undoubtedly due to the equally rapid development of the mining industry in that province, and one would be well justified in saying that the mining industry alone will be the basis of colonization in this region of Quebec, which lies north of the Height of Land. The reports of explorations found in the records of the Canadian Geological Survey and in the reports of the Commissioner of Crown Lands for the province of Quebec, indicate that there are large grass areas on the shore of James Bay between the latitudes of 51° to 52° north, and between longitudes 77° to 79.30°, west of Greenwich, and that cattle at this low altitude could well survive the winter weather, and could be well fed on these grass areas, but it is difficult to see any market or any future for the settlement of these grazing areas, or of any part of the region to the north, unless a population is established between the Height of Land and the northern boundary of Quebec; and the only matter which can bring such a population permanently into such a country would be the finding and development of profitable mineral.

Therefore, if the liberty may be taken, the REVIEW would suggest that the problem before the Quebec Cabinet is not, at present, one of *colonization*, but one of how best to encourage the *discovery and development of minerals* in this Huronian Belt which runs throughout the whole of the province north of the Height of Land, and which has been proved to be very valuable in minerals in that eastern section which borders the shores of Lake Chibogamoo.

The existence of asbestos, in large quantities and of a quality fully equal to the best that is in the market, of very large veins or bodies of copper-bearing and gold-bearing quartz; of reported veins of argentiferous galena; of disseminated magnetites and chromites, all indicate clearly that the eastern end of this belt of greenstones contains mineral of merchantable value in large quantities, and one is justified in assuming that the extension of this Huronian area westerly will likewise contain valuable mineral deposits. This belief is further substantiated by the periodic reports which have been brought to the Trans-Continental Railway Commission by the engineers who have been surveying trial lines and endeavouring to get a location line through this section of Quebec. Should valuable minerals be found, it will be a rich man's country, similar to British Columbia, and not a poor man's country; for vast expenditures will be required, not alone to mine the ores but to reduce them or treat them, and therefore investment of many millions of dollars will be required for the development of the country. How to attract this capital and secure the amount of money needed are questions that must be met by the Provincial Government, which cannot afford to solve them in any but a wise manner. Here again experience may be taken from the history of British Columbia; concessions made to capitalists of unquestioned experience and undoubted financial strength have been proved wise, and have full justification. Quebec, in all probability, has great resources in this northern country, but with her sister province, Ontario, occupying the public gaze with the extensive and rich discoveries of silver-cobalt-nickel ores in Temiskaming, and with Mexico offering a wide and comparatively cheap field for mining investment, having also 300 working days in the year with low wages for labourers, Quebec certainly has no points of advantage, but is rather at a disadvantage, and all such disadvantages and difficulties should be taken into consideration, and judicious concessions granted by a government which has the interests of the province at heart. Undoubtedly, on this line, the framing of a new mining law would be advantageous. Under the existing law there are many sections justly needing criticism. The tying-up of large areas under prospecting licenses and the permissive renewal of these licenses without bona-fide expenditure of labour and capital, is a point frequently criticized by mining men. The tying-up of large areas without the expenditure of money upon the same is a draw-back to any country, and we have no doubt that the present Minister of Mines fully realizes this, and will change the same at the earliest possible moment. With a modern, reasonable and definite mining law, with adequate protection and encouragement to capital, and the utilization of men experienced in Canada rather than the employment of men who have no knowledge of the conditions which exist in Northern Canada, there are substantial reasons for predicting a splendid future for the mineral development of Quebec in this northern Section.

THE KAKABEKA ELECTRIC POWER CO.

The work of developing the water power of Kakabeka Falls near Fort William has been practically realized and by June of this year power for all the industries at Fort William will be available from this source. The work has been in charge of Mr. R. W. Leonard as civil engineer, with whom has been associated Mr. R. S. Kelsch as electrical engineer and Mr. William Kennedy Jr. as hydraulic engineer.

The waters of the river are taken through a pipe 10 ft. in diameter to a point about three quarters of a mile above the falls where a large reservoir has been constructed to act as a fore-bay, from which runs the steel penstock which carries the water to the power house which lies 180 ft. vertically below the fore-bay. The whole of the work has been carried out with a view to dispensing with anchor ice, and the principal materials of construction have been cement and steel.

The initial installation will be 10,000 horse power which will be increased as needed from time to time. The waters of Shebandowan and Dog Lakes are to be conserved by dams so as to afford an abundant supply of water for all the power likely to be required in the future. The total cost of the work is put in the neighborhood of $2,000,000, and the voltage from the power house to the sub-station will be 25,000. To provide against accidents the transmission line is in duplicate. It is the intention to supply power to all users of five H.P. or over, and the rate to be charged will not exceed $25.00 per horse power per annum.

THE BUTTE COPPER FIGHT.

That the long contested litigation between the Amalgamated Copper Co. and the Heinzes has been brought to a close seems to be evident from the various news reports which have been current during February, but no details have been allowed to leak out to the public. It would appear from Press reports that some large financial interests, in nowise interested in either the Amalgamated or Heinze properties, have been approached for their assistance and have been consulted in the matter. These strong interests are reported to have counselled an amicable amalgamation or adjustment of difficulties in the interests of the general business situation of the country. Report has it that the Guggenheims are financially interested in the present negotiations.

In the meantime a corporation has been organized in New Jersey under the name of the Butte Coalition Mining Co., which will take over the Heinze properties with a capital of $15,000,000, the shares having a par value of $15.00 each. This capitalization and the first board of directors will be temporary only.

The main interest to the general public lies in two facts, that peace will now replace a bitter business and personal warfare, and that the copper monopoly of the United States is now an assured fact.

JOHN STANTON.

The death of John Stanton, which occurred in New York City on the morning of Friday the 23rd. of Feby. removes one of the most notable men in the history of the Copper Industry of North America. Mr. Stanton's death was due to heart failure. He was born in Bristol, England on the 25th. of Feby. in 1830 and was the son of John Stanton, a Civil and Mining Engineer who came to America in 1835. Mr. Stanton senior bought coal lands in the neighborhood of Pottsville, Penn. and instructed his son in the profession of mining engineering to such good effect that at the age of 17 he was put in charge of some iron mining operations in New Jersey. Subsequently, in 1850, he became interested in some minor copper deposits in Connecticut and also explored for copper in Pennsylvania and the Southern States.

In Tennessee he obtained valuable deposits in the neighborhood of Ducktown which he worked until the mines were confiscated by the federal government during the civil war. After the war Mr. Stanton became interested in the copper deposits of Lake Superior where he developed several valuable mines and made a permanent name in connection with the *Atlantic* Mine, which has long been famous for its profits obtained from rock carrying the least copper of any copper mine which has been worked successfully. For years Mr. Stanton was the treasurer of this property and it was due to his unusual ability, in both a managing and a business way, that the Atlantic Mine has been rightly considered a model of economy, ability, and an all-round honesty and fairness. His work at the *Atlantic* as also at the *Wolverine*, where his courage and personal loans rescued the property from abandonment and brought it to the position of being, in proportion to its size, the most profitable copper mine in the Lake District, is of itself a monument.

Mr. Stanton was one of the ablest mining engineers of the day; he was one of the founders of the Metal Exchange and was its president in 1876. He was also a member of the American Institute of Mining engineers and was at one time president of the Engineer's Club. He occupied also the position of director on the boards of many corporations, and of the Granby Copper Co. of British Columbia.

SMELTING OF MAGNETIC IRON ORE BY ELECTRICY.

(From the Mining and Scientific Press.)

A preliminary report on the subject of smelting by electricity the magnetic iron ores obtained from various points on the Pacific beach has been submitted by Dr. Day to the Director of the U. S. Geological Survey.

After considerable correspondence with the patentees of various forms of electric furnaces, arrangements were made with the Wilson Aluminum Company of New York for the services of C. E. Wilson, their expert in electrical smelting. Mr. Wilson arrived in Portland Ore. on October 11, and at the end of one week had erected a small but efficient electrical furnace, and was making steel. He had procured in the East 25 carbon electrodes—each 48 inches long and 4 inches square—such as are ordinarily used in electric furnaces. The rest of his equipment was obtained in Portland from materials kept in stock or easily made at a foundry.

In building the furnace a course of ordinary Carnegie fire bricks was laid upon the ground. Upon this single course was laid a cast-iron plate, ⅝ inch thick, 3 feet long and 3 feet wide. On this was placed an oval sheet-iron drum of No. 16 iron 3 feet long by 3 feet high. The sides of this drum were lined with fire bricks to form a crucible 18x18 inches and 24 inches high. The bottom of the crucible was covered, from the cast-iron plate up to the tapping hole, with broken carbon electrode. The carbon electrode to carry the current was suspended by a pulley above this furnace and connected with a balanced axle and wheel by which it could be readily raised or lowered. The top of the furnace was covered with two double plates of riveted wrought iron, between which cold water was run. In the center of this water-jacketed cover an opening was left sufficient to allow the free play up and down of the carbon electrode. This furnace is referred to as "Small Furnace," or "Furnace A."

Power for Furnace A.—Through the co-operation of the Portland General Electric Company, a special wire, bearing a 2300-volt alternating current, was run from the city supply to the smelter. This was carried into a series of six transformers and yielded a current varying from 50 to 20 volts by 1000 to 2000 amperes.

Initial Run of Furnace A.—On the afternoon of October 17, a current of 57 volts and 1000 amperes was passed through the furnace and the arc established. The furnace was then fed with a mixture of magnetite, coke, and lime. This consisted of 200 pounds of magnetite, obtained from the sand at Hammond Station, near Astoria, Or., at the mouth of the Columbia River; 44 pounds of "Fairfax" coke, which contained about 25% of ash; and 24 pounds of lime. About 50 pounds of this charge was slowly introduced into the furnace, and within an hour there was tapped from the furnace 70 pounds of steel, which contained 8% of iron and 53% of titanic acid.

On the following day the furnace was again heated and filled with a mixture similar to that used on the first run, except that it contained less lime. Steel was successfully cast twice, making, for that day's run of two hours, a product of 90 pounds of steel from 300 pounds of iron ore. This gives the furnace a capacity, on a continuous run, of 1440 pounds in 24 hours.

Composition of Charge.—The iron ore fed to the furnace showed the following percentages of magnetic oxide, of titanic acid, manganese, and undetermined matter:

ANALYSIS OF COLUMBIA RIVER CONCENTRATES.

Fe_3O_4	79.06
TiO_2	16.00
MnO_2	2.45
Silica, moisture and undetermined matter	2.49

It will be noted that the heat was sufficient to keep the entire slag in a fluid state whether much or little titanic acid was present. It is evident also that no titanium went into the iron. Instead of the steel usually obtained, the charge of October 20, at shown by the analysis of that day, gave what was practically pig iron.

Nature of Slags Obtained from Furnace A.—The slags first obtained consisted of fused iron silicates, fused oxides of iron, and silicate of titanium. Later in the experiments these slags grew lighter in color and in specific gravity. It became possible also to lessen the quantity of slag produced, which was unduly large owing to the great quantity of ash in the coke. The coke used showed on analysis 41% of ash. It is difficult to procure in this locality coke that is well adapted to metallurgical needs.

Furnace B.—Experiments with the small furnace having been successful, it was thought desirable to build a larger furnace, with thicker walls, in which higher temperatures might be obtained and maintained. An iron plate 2 inches thick, 5 feet wide and 6 feet long was therefore procured and laid upon two courses of fire brick, to form the base of a furnace, on which was set a wrought-iron cylindrical shell ¼ inch thick, 5 feet in diameter and 4 feet high. This was lined with fire brick, the bottom having the usual lining of one course of carbon electrode bricks 4 inches in diameter. Two carbons clapped together with a water-jacketed head or clamp formed the electrode for introducing the current. The voltage was run up as high as possible—that is from 75 to 90 volts, the limit of the current obtainable over the wires. In all respects except these mentioned, this second furnace is identical with the first.

Iron ore from Aptos, Bay, of Monterey, California, was smelted in this furnace on November 10. This iron ore is very fine grained and contains a notable percentage of manganese, much of which goes into the steel. It is not so rich in titanium as the other sands that had been used. From the start this furnace made a satisfactory run, maintaining easily a high temperature and turning out a very smooth product. After a few trials the slag became as light in color as that from any well regulated blast furnace. The later products of steel were much denser than those first made, which would seem to indicate that, at the higher temperature, the process of reduction is complete, even in the short time that elapses between the beginning of reduction and the tapping. In every case, however, small blow holes were observable in the steel. These were due to gases which formed wherever grains of magnetite were still entangled in the steel in process of reduction. The capacity of this furnace with a current of 125 volts, 1200 amperes, would be 2000 pounds in 24 hours.

RECORD OF DAILY RUNS OF FURNACE A.

No. of Run	Date	Hours Run	Volts	Amperes	Magnetite	Mixture Used: Coke	Mixture Used: Lime stone	Sand	Total Weight of Mixture	Metal Tapped From Furnace	Slag Produced	Carbon Electrode Consumed	Horse Power	Steel Produced per horse Power Day	Magnetic iron Ore per Pound of Steel
	1904.				Lbs	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.
1...	Oct. 17.	1½	57	1000	200	44	24	......	268	70	......	1.80	76.40	14.66	2.86
2...	Oct. 18.	2	57	1000	300	60	30	......	390	90	200	2.10	76.40	14.14	3.33
3...	Oct. 20.	2	57	1800	97	19	8	......	124	23	125	1.20	137.53	2.01	4.22
4...	Oct. 20.	2	57	2000	91	21	4	......	116	120	88	3.50	152.81	9.42	.76
5...	Oct. 21.	2	57	1800	150	74	7	......	231	23	115	2.30	137.53	2.01	6.52
6...	Oct. 21.	2	57	1800	102	27	2	......	131	106	105	3.20	137.53	9.25	1.03
7...	Oct. 23.	8	57	1200	500	100	24	10	634	247	410	2.80	91.68	8.08	2.03
8...	Oct. 25.	3	57	1200	202	40	12	12	266	38	150	3.50	91.68	3.31	5.32
9...	Oct. 26.	1	115	800	298	60	30	10	398	122	120	4.00	123.32	23.75	2.44
10...	Oct. 27.	5	115	1200	800	154	96	......	1056	263	318	2.00	184.98	6.83	3.04
11...	Oct. 30.	3	115	1200	800	152	64	......	1018	200	400	1.50	184.98	8.65	4.00
12...	Oct. 31.	5	115	1200	1200	175	112	......	1487	575	280	3.00	184.98	14.92	2.09

RECORD OF DAILY RUNS ON FURNACE B.

No. of Run	Date	Hours Run	Volts	Amperes	Mixture Used: Magnetite	Mixture Used: Coke	Mixture Used: Lime stone	Total Weight of Mixture	Metal Tapped From Furnace	Slag Produced	Carbon Electrode Consumed	Horse Power	Steel Produced per horse Power Day	Magnetic ron Ore per Pound of Steel
	1904.				Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.		Lbs.	Lbs.
1....	November 10..	4	100	1200	1000	200	160	1360	480	250	2.00	160.86	17.91	2.08
2....	November 11..	7	75	1600	1000	250	48	1298	175	312	3.69	160.85	3.69	*a*5.71
3....	November 14..	9	80	2000	858	154	18	1030	450	457	6.00	214.47	5.59	1.91
4....	November 16..	8	80	2000	800	170	84	1054	*a*1025	500	8.00	214.47	14.34	*b*.78

a Metal not all tapped.
b Includes metal not tapped from previous run.

THE HUNTER V. MINE, BRITISH COLUMBIA.*

By JAMES ASHWORTH.

Aerial Cableway.—The Hunter V. and Double Standard claims, belonging to the British Columbia Standard Mining Company, Limited, are located on the top of a mountain near Ymir, and may be reached either by aerial cableway, horseback or on foot.

This aerial cableway, being one of the most recently erected in British Columbia, may be safely assumed to exemplify some of the best points in this mode of transportation. The distance between the terminal stations of the main cableway is 13,000 feet, and there are in addition two supplementary cableways, 1,800 and 500 feet long respectively. All three are worked separately, entirely by gravity, and the speed is regulated by powerful brakes on the clip-wheels at the upper stations.

On the main cableway, the top or fixed ropes, 1¼ inches in diameter, are in two lengths, the first being anchored at the top station (Fig. 1), and tightened from time to time as required at a station about midway (Fig. 2). At this station, the bottom length is also anchored, and is tightened, as required, at the bottom terminal station (Fig. 3).

On the Hunter V. cableway, the longest length between the supporting towers is about 1,800 feet, and the height above the ground is about 300 feet.

The haulage rope, ¾ inch in diameter, is an endless rope. The buckets, of which there are 30, are placed at equidistances apart. When the rope is running at the rate of 400 feet per minute, 100 tons of ore can be easily transported and delivered into cars on the railway, in 10 hours; and this quantity can be increased by adding extra buckets.

*Excerpt from the Trans. I. M. E.

Special cradles are used for carrying men and timber: two of these cradles being placed a short distance apart, so that the timber, in transit, is supported at both ends, and, therefore, rides practically horizontally.

Every movement in the loading and unloading of the buckets, is, as far as possible automatic: thus, starting from the bottom station (Fig. 3), the catches which fasten the bucket in position when loaded, are opened by a fixed disengaging arrangement (Fig. 4),

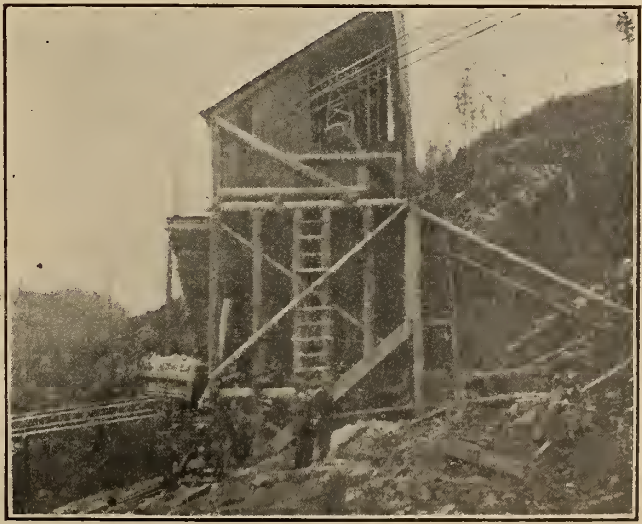


FIG. 1.—TOP STATION OF THE MAIN CABLEWAY: THE ORE-BIN BEING FILLED BY THE SUPPLEMENTARY CABLEWAY.

and the bucket (say, No. 26) dumps its contents into the ore-bin without a stop, and then, passing onwards round the return wheel, continues its course back to the mine with the bucket in an inverted position. The object of running the inverted bucket is to prevent water or snow from filling it whilst in transit. On arrival at the top station the bucket strikes an inclined-plane arrangement (Fig. 5), which forces the bucket into its proper position and allows the catches to close on to the hooks, and it is then ready for loading on the other side of the clip-wheel. Here a man, by means of three levers (Fig. 6), regulates the loading and the movements of the main cableway. In the intervals of time, between the buckets passing this point, the man opens the shoot, A, close at his left hand, and fills the automatic loader, B, shown below. On the arrival of a bucket (say, No. 23), a catch on the hanging frame of the bucket engages with a bar on the loader, B, and takes it in tow, and then the loader automatically discharges its contents into the bucket, while still in motion. The loader, after traversing a certain distance (Fig. 7), disengages from the bucket, and is brought back to its original position, by a counterbalance-weight, ready for loading from the bin.

Fig. 2.—Midway Anchorage of the Main Cableway.

The ore-bin is filled by the supplementary cableway, and the buckets are dumped automatically (Fig. 1).

The buckets at the top and bottom stations (Figs. 4 and 5) are run from the cable on to fixed edge-rails, which conduct them round the clip-wheel and the return-wheel. Fig. 8 shows a line of derricks where the line makes a curve over one of the hills and also shows an inverted bucket returning to the mine. The return-wheel (Fig. 4) is mounted on a movable platform, by means of which, and a heavy counterbalance-weight, the haulage-rope is kept in tension. The flanged wheels (Fig. 5) are made in halves, so that the tread of the wheel, which is a separate part, and is fixed in position by molten lead, may be removed and replaced, without the expense of having an entirely new wheel.

This mode of transportation can be applied for the cheap transit of ore and materials over long distances, and for heavy outputs. Another aerial tramway, under erection, has a length of 3½ miles, and a capacity of 800 tons per 10 hours; and another one 4½ miles long, demonstrates that long and continuous lengths can be worked by this system, without its being necessary to place the ropes in one straight line. This mode of transportation being simple in its details, the movements being as far as possible automatic, and the working power being gravity, it is obvious that the cost per ton of material moved is very low.

When the writer travelled on this cableway, the time occupied in the transit to the mine, which is at

Fig. 3.—Bottom Station of the Main Cableway.

Fig. 4.—Interior of the Bottom Station.

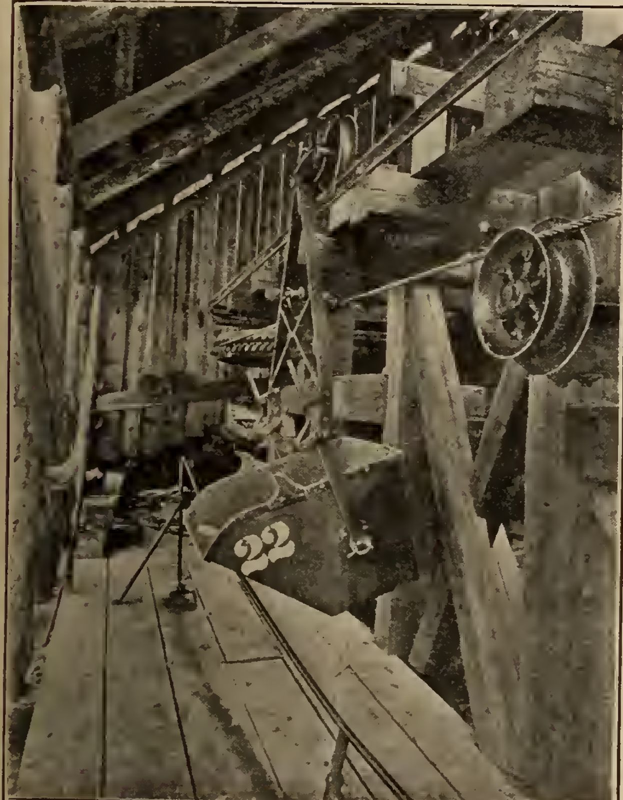


Fig. 5.—Interior of the Top Station.

an elevation of 5,500 feet above sea-level, was about 50 minutes.

Hunter V. Mine.—The Hunter V. group of claims includes, within its boundaries, portions of a limestone-deposit, the extent of which has not yet been fully ascertained. Locally, it forms the upper portion of the mountains near the head of Porcupine Creek, in the Ymir district. In the company's claims, the deposit is in the shape of a tongue, about 2,000 feet wide, and several miles in length. It is surrounded on three sides by a more or less altered gabbro of later origin, and belonging, it is thought to the Carboniferous age. The gabbro cuts into the limestone in places, whilst in others the limestone appears to be entirely surrounded by igneous rocks, just as if portions had become detached from the main mass, and had floated off into the molten magma. No fossil remains have been discovered so as to establish definitely the age of the limestone.

Fig. 6.—Loading Side of the Top Station.

Where least disturbed, the bedding planes strike in an east-and-west direction, and dip slightly to the south. In the process of mountain-building, the mass has, like many other parts of British Columbia, been subjected to great strains, with the result that in places it is faulted, folded and contorted into confusing shapes, and the original structure is almost entirely obscured. Fractures have also been formed, in which the circulating waters have re-deposited the lime as pure calcite, and these occur in irregular bands throughout the mass, varying in thickness up to 6 or 8 feet. At some other period, siliceous solutions appear to have circulated throughout the formation, and silica has been deposited in the free state, as also in combination with lime, magnesia, etc.

Fig. 7.—Loading Side of the Top Station.

The most conspicuous minerals that have been found are tetrahedrite (grey copper), zinc-blende, galena, pyrites and native silver.

The origin of the mineralization has not yet been determined, but it will no doubt be traced to the more recent eruptive rock surrounding it, and near the contact of which the largest mineralized areas have been discovered. It appears, however, as an impregnation in the limestone-deposit, and no lines can at present

FIG 8.—CURVED LINE OF DERRICKS.

be laid down to trace it to its source, because irregularity of occurrence, and indefiniteness of shape, appear to be its chief characteristics.

The mineralization is more evident on the surface, in the bedding planes of the limestone, which the decomposition of the grey copper often colours green, whilst crystals of azurite are frequently seen scattered along these lines of enrichment.

Native silver, in leaves or plates, is more particularly met with on the faces of joint-planes, and may have been reduced and deposited there through the agency of surface-waters containing organic matter. Planes of fracture are common, some showing incipient movement and others none, but they appear to have an important bearing on the deposition of the ore, for in many cases it is found to be richer on one side of such planes than upon the other.

The opening of the mine has been principally confined to two areas, one on the Hunter V. claim, at the top of the hill, where the face of the quarry at present shows a width of over 70 feet of ore; and the other on the Double Standard claim, 1,400 feet distant, and vertically over 400 feet lower down the hill, where the Glory Hole is more than 120 feet wide, showing mineralization from side to side. Other outcrops of mineral have also been discovered on various parts of the property, though not at present opened up.

This deposit of limestone is unique in the district, and until it is further explored, a more comprehensive study of the occurrence cannot be made.

When the quarries are more fully opened out, the ore will be delivered into railway-cars at a cost of 4s. 2d. (1 dollar) or less per ton.

The ore, up to the time of the writer's visit, averaged about 13 per cent. of silica and 44 per cent. of lime; at times, the silica had run as low as 9 per cent., and the lime had risen to 48 per cent.; but experience had shown that an increase of silica did not necessarily mean a proportionate fall in the percentage of lime. These figures show that this ore is a valuable flux to the smelters. The ordinary limerock, which is used by the various smelters as a flux, when delivered at Nelson or at Trail, costs about 6s. 3d. (1½ dollars) per ton, and at Northport 2 s.8½d. (65 cents) per ton; and such limerock contains about 48 per cent. of lime and 8 per cent. of silica.

In what form the gold and silver are combined has not yet been determined, excepting so far as the native silver, and the silver contained in the grey copper are concerned. The gold-contents have proved to be relatively higher in the Double Standard than in the Hunter V. claim, and it is in the former that the most siliceous material has been found.

Conclusion.—These few notes would, the writer thinks, be incomplete, without a reference to the excellent food provided at the mining camps, fully equal to an average hotel; and the cook, particularly if he happens to be a white man, receives a much higher salary than a good clerk will receive in this country. A white cook, who satisfies the miners, is a valuable acquisition both to masters and men.

At some camps, which are in a sense out of touch with civilization, there is no actual observance of Sunday, because it has been found that its non-observance is a lesser evil than idleness.

The writer's thanks are particularly due to Mr. N. Carmichael, Mr. J. J. Campbell, Mr. J. Johnson and Mr. W. S. Riblet for the technical details recorded in this paper.

THE NATURE OF ORE DEPOSITS.

BY DR. RICHARD BECK,
Professor of Geology and Economic Geology in the Freiberg Mining Academy.*

(REVIEWED BY FRANK D. ADAMS, Ph. D.)

The first edition of Dr. Beck's "Lehre von den Erzlagerstaten" was published in Berlin in 1901, and was followed by a second edition two years later, in 1903. Simultaneously with this second edition, a French translation of the work appeared. The English translation by Mr. Weed, which has just been issued, may be considered as the third edition of the work.

Mr. Weed states in the preface that he was originally asked by the publishers to practically re-write the book from an American standpoint, giving greater prominence to American ore deposits, but that this idea was abandoned because it would involve serious abridgements of the descriptions of important foreign localities, which descriptions make the work especially valuable to American engineers and geologists. Mr. Weed has not, however, confined himself solely to translating the work, but has written new descriptions of many American ore deposits which have, of recent years, been carefully studied. The nomenclature employed in the German edition has in some few details been made to conform more closely to American usage, but otherwise the book is essentially identical with the last or second German edition with the exception of Mr. Weed's additions. In this American edition, however, the book appears in a form which is more conveniently handled, the single large volume of the German edition having been divided into two volumes. This division has, however, been made, strangely enough in the middle of a section without reference to the sense of the text, while by adding a few more pages to the first volume a much more suitable division of the subject matter could have been obtained. The book is clearly and simply written, and is well illustrated by cuts and diagrams. It is the most comprehensive general treatise on the subject of ore deposits which we now have in the English language.

After a preliminary section dealing with definitions and literature, the Classification of Ore Deposits is taken up.

The classification adopted is as follows:—

(I). PRIMARY ORE DEPOSITS.—
- A.—Syngenetic; formed simultaneously with the country rocks.—
  1. Magmatic segregations.
  2. Sedimentary ores.
- B.—Epigenetic; formed later than the country rock.—
  1. Veins.
  2. Epigenetic deposits other than veins.—
     - (*a*) Epigenetic deposits; formed essentially by an impregnation of non-calcareous rocks, the deposits being generally in distinct beds.
     - (*b*) Epigenetic stocks, formed essentially by a metasomatic replacement of calcareous rock mostly in the form of stocks, pockets or stringers.
     - (*c*) Contact metamorphic ore deposits; ore beds and stocks formed through contact metamorphism caused by Plutonic intrusive masses.
     - (*d*) Ore bearing cavity fillings; deposits formed essentially by a simple filling of pre-existing cavities mostly in the form of stocks or stringers.

*Translated and revised by Walter Harvey Weed, E.M., Geologist, United States Geological Survey, with 272 figures and a map. First edition in two volumes, New York and London *Engineering and Mining Journal*, 1905.

(I). Secondary Deposits.—

1. Residual deposits.
2. Placer deposits.

Each of the classes of ore deposits is then taken up in succession, and some of the most notable examples described.

Under the head of Magmatic Segregations, three classes are distinguished, namely:—

(1). Segregations of native metals.
(2). Segregations of oxide ores.
(3). Segregations of sulphide and arsenical ores.

With regard to group three it is stated "that the evidence that deposits of this class are direct segregations from a molten magma is not as clear and conclusive as it is in the case of groups one and two." This it is affirmed is particularly true of the Norwegian nickeliferous pyrrhotites, and it is added that recent microscopic study has proved that the Sudbury deposits are metasomatic replacements and that there is "not a single example of magmatic copper deposits known in North America." Whether this conclusion is justified or not, will be discussed in a series of papers on these Sudbury deposits, which will appear shortly in the new magazine *Economic Geology*, by several gentlemen who have devoted special study to these deposits and who are in a position to speak authoritatively concerning them.

The Bedded Ore Deposits which are next considered are represented by a large number of occurrences chiefly European, which are well described. Among the American deposits of this class are the ores of the iron ranges of Lake Superior. The treatment of these is rather inadequate, and it would seem better, even at the cost of slightly enlarging the book, to have presented a more complete and better balanced account of what are in fact the most important iron deposits in the world. In the account as given there are some inaccuracies. Thus, on page 78 the "soft ores" are said to be brown hematite. These ores, however, do not hold sufficient water to be so classed, for while undoubtedly specimens of brown hematite can be obtained from these soft ores, they, as a class, are essentially red hematite, only partially hydrated, the average content of water in the Marquette ores being 5.4 per cent. while in the Mesabi range, whose product may be said to consist entirely of soft ores, the average content of water is only 7 per cent, while brown hematite has twice this amount of water. Again, on page 23, the iron ores of the Mesabi range are said to belong to the class of magmatic segregations, while on page 80 they are said to have originated in the same manner as those of the Penokee-Gogebic and other iron ranges of the district, which are classed as sedimentary deposits. On page 78, grunerite is referred to as "almost pure *ferric* silicate in the form of hornblende." In the same class are the Clinton ores which also merit a much more extended description.

The Epigenetic Deposits are then taken up, their description being prefaced by an excellent "General Description of Mineral Veins," treating of their structural relation to the country rock, structure of the vein filling, &c., and including a discussion of the origin of vein fissures and of the dislocation of veins, faulting, &c., which occupies 80 pages.

The numerous occurrences of vein deposits are grouped according to the ore which they contain, and examples of the several groups are considered in succession. The definition of a vein given by Emmons, "A single mineralized fissure, or the ore body formed along a single fissure," is accepted, although Beck states that he "does not entirely agree with S. F. Emmons, who attributes the important role in the formation of many veins to metasomatic processes, as such processes are always regarded by him (R. B.) as subordinate phenomena in vein formation."

Under this class of deposits a good description is given of the tin deposits of the Erzgebirge, and it is noted that in the case of the Zinnwald occurrences at least "the impregnation with tin-stone occurred before the last phase of volcanic activity in the region." This is followed by briefer descriptions of the Cornish tin deposits, and of the "tin districts" outside of Europe.

The next section treats of that extremely interesting class of deposits which mark the transition between tin deposits of the usual type and ordinary mineral veins and which find their best exemplifications in the occurrences of the Cerro de Potosi and other Bolivian deposits. Under this heading are also described the veins of Butte, Montana, and the native copper deposits of Lake Superior are here taken up as a whole, although few of the important deposits of this region are really veins. This latter very important district is also one which merits a more extended description, the conglomerate deposits being disposed of in some six lines. The opinion is expressed that "genetically these deposits are best explicable by the assumption of a lateral secretion of the copper ores which were originally finely distributed in the melaphyres, the only enigma being why the secretion and concentration took the form of native copper."

It is noted in the discussion of the silver lead veins that the three types of these veins recognized by Herder in the Freiberg district have been found to exist with but little variety in the mineral districts of all parts of the globe, "so that they are really of universal application." These are: (1) the pyritic lead quartz veins, (2) the high grade galena veins with carbonated gangue, and (3) the galena barite veins. The veins of these classes in the Freiberg district are described in detail, and a good map, showing the distribution of the several systems of veins in this classical locality is given. Representatives of the several classes in many other parts of the world are also described and compared with respective occurrences in the Freiberg district.

The veins of the rich cobalt silver ores of the Joachimsthal and Annaberg districts, to which the recently discovered veins of the Cobalt district of Ontario are so closely allied, are then described in detail. It is mentioned that as early as 1517 a mining settlement existed in the Joachimsthal district, and that in 1518 the first "Joachimsthaler" was minted, this coin now being known as the "Thaler." It is stated that special attention is now being paid in these districts to the extraction of uranium.

In connection with the gold quartz veins, their close relation to pegmatite intrusions is noted. During the cooling of a body of granite magma, the water and the various gaseous compounds became more and more concentrated in the residual mother liquor during the crystallization of the magma. The residual solutions, penetrating into fissures, deposited vein quartz together with vein substances and non-silicated compounds, which were comparatively uniformly distributed in the molten magma but which gradually retreated into the residual water.

Having described these deposits, an abrupt break is made and the "General Description of Veins" is resumed and con, tinued through forty pages. The statement made to the effect that this description is continued from page 226 is evidently a misprint, as it is really continued from page 195. This section takes up the consideration of "Differences in Vein Content at Different Depths," which are considered under the heads of changes in primary filling and due to secondary alteration; "the Distribution of Ore within the Vein"; the "Influence of the Country Rock on the richness of Lodes"; "the Influence of the Vein Intersections on Ore Content;" "the Influence of Converging and Diverging Stringers on the Content of Veins"; "Action of Vein Solutions upon the Wall Rock," &c.

Under the changes in the character of primary ore filling, the progressive replacement of galena by zinc blend and pyrite in depth is noted in the case of a number of well known occurrences, as, for instance, in the Freiberg veins, in those of the Upper Harz, in the silver lead ores of the Castle Mountain and Barker districts of Montana, as well as in the Elkhorn deposits. This same change has also been observed in other cases not mentioned by the authors, as in the Joplin district of Missouri, which is mentioned by Van Hise, and in the silver lead veins of the Kootenay district of British Columbia. This change, however, in the case of the Missouri occurrences is regarded by Van Hise not as one of the primary ore filling but as due to the secondary action set up by descending waters.

The superficial alteration of ore deposits in the zone of weathering and the various classes of products resulting from this, are then described at length.

The "Action of the Vein forming Solutions upon the Wall Rock" are taken up and considered under the heads of "Sericitization", "Kaolinization", "Propylitization", "Silicification", "Alteration of limestones into ore-bearingp yroxene-epidote Rocks", "Tourmalinization" and "Topazitization" and "the Metasomatic replacement of the country rock by Ore."

There is inserted at this point a "Review of the various Theories of the origin of Mineral Veins." These are classified as follows:—

(1). Congeneration Theory.
(2). Descension Theory.
(3). Lateral Secretion Theory.
(4). Ascension Theories.
 (*a*) The Igneous Injection Theory.
 (*b*) The Sublimation Theory.
 (*c*) The Hydrothermal Theory.

Numbers 1 and 2 may now be said to be of merely historical interest and with regard to the theory of Lateral Secretion, the opinion is expressed "that any general application of the theory is decidedly impracticable," although a few occurrences are mentioned which may have originated in this way. The Igneous Injection Theory is also of merely historic interest although it has lately been resuscitated by Weinschenk and applied to the pyrite deposit of Bodenmais. The authors maintain that the Hydrothermal Theory affords the true explanation of the origin of mineral veins. "We maintain that the original formation of most ore bodies is due to *thermal water rising from great depths. These thermal waters are believed to be the after-effects of Plutonic eruptions, such as the intrusion of granitic masses;* also of volcanic events in the narrower sense." It is not clear however, whether these thermal waters which are the after-effect of volcanic action are regarded by Beck as "juvenile" waters in the sense of Suess, or are waters which having percolated from the surface have been rendered especially active agents of solution and deposition by the heat communicated to them by the intrusions in question.

The description of "Epigenetic ore deposits in Stratified Rocks' is then taken up, and a large number of occurrences are described, among the more important of which is the Mansfield "Kupferschafer" and the Transvaal gold-bearing conglomerates. With regard to the former, the authors do not believe that the copper was derived from any process of direct precipitation from the ocean waters in which its shale was laid down, but point out that "wherever the formations comprehended under the name Kupferschiefer are ore-bearing, the Zechstein and its underlying rocks are found traversed by numerous fissures which have in part the character of mineral veins. The generally recognized fact that with few exceptions the amount of copper in the shale increases on approaching these fissures and dislocations is direct evidence in favour of impregnation from the fissures."

The Transvaal gold-bearing conglomerates are described in considerable detail, and the various theories which have been proposed to account for the gold in them are discussed, that which accounts for the subsequent introduction of the gold by the invasion of the porous conglomerates by gold bearing solutions being preferred.

The term *epigenetic ore stock* is given to all stock shaped, pocket shaped and tube shaped ore bodies found in limestone or dolomites, and which are formed by the metasomatic replacement of the carbonates by ores and accompanying minerals. Among the examples of these, the spathic iron ores of the Bilbao District; the copper deposits of Bisbee, Arizona; the ore deposits of Laurium; the lead and zinc deposits of the Mississippi valley and others are described. Beck considers that in the case of the last mentioned "the presence of darite and fluorite, in fact the entire mineral assemblage of the deposits, so closely resembling that of the genuine silver-lead veins of hydrothermal origin, indicates that the hydrothermal theory is the correct one, especially since it will hardly be proved that the zinc and lead contents of the limestone were not themselves introduced by subsequent infiltration." A similar origin is attributed to the Leadville deposits.

The Contact Metamorphic Ore Deposits, to which an ever increasing number of ore deposits is being referred, embraces ore bodies formed within stratified rocks under the influence of contact metamorphism near or along the boundary between plutonic eruptive masses and stratified rocks. The most important criterion for the recognition of these deposits is considered to be their mineralogical composition, the ore being characterized by the presence of certain minerals which we know elsewhere to be typical of igneous contact zones, e.g. Garnet, Wollastonite, Vesuvianite, Andalusite, Cordierite, Scapolite, &c. There is, as is pointed out, a very close genetic relationship between ore bodies of this class and magmatic ore segregations.

The Contact ore deposits of Banat, Hungary; those of the Christiania Region and of the Island of Elba, with a number of others, are described as examples of this class of ore bodies, which is one one that merits a much more close and thorough study than has heretofore been given to it.

The work closes with the consideration of the several classes of detrital deposits.

The book is an excellent one and is especially useful to the English speaking student as presenting a description of many foreign ore deposits, information concerning which is otherwise to be found only by extended search through a great mass of literature. The book, however, might be improved if the material were in a measure re-arranged by discussing for instance the origin of the epigenetic deposits in one section instead of taking up the question of origin in connection with each subdivision separately, for the same reasoning applies to all these deposits irrespective of shape.

The type employed for the headings of the various sections might also be made more distinctive as in the German edition which, in this respect, is much clearer. There also seems to be some mistake with regard to the statement on the title page that the book is illustrated by 272 figures, as only 257 can be discovered by the Reviewer. These, however, are minor faults, and the book is one which every one interested in this most important branch of Geology will welcome.

BEQUEST FOR MASSACHUSSETTS TECH.

The late Frank Harvey Cilley, engineer, has bequeathed the residue of his estate, which will probably amount to $70,000, to the Massachusetts Institute of Technology for the purchase of suitable books, photographs, casts, anatomical models and statuary for the library and gymnasium of the proposed Walker Memorial gymnasium, or for special lectures on physical culture.

MODERN METHODS IN SHAFT SINKING.

A few years ago there would have been no benefit in using large engines during sinking, as the progress of the work at the bottom of the shaft was so slow that the debris could easily be wound by self-contained engines, with a drum of 3 or 4 feet in diameter. But now that the sinking progresses more quickly it is essential to wind rapidely. Of course safety must not be overlooked, as it is certain to be a serious matter if anything happens to the bucket whilst it is in the shaft or when it is being unloaded at the top. By means of the ropes and rider the bucket is steadied during its journey, and passes up and down the shaft at a rapid rate more safely than was formerly possible at a slow wind. By using folding doors many dangers during banking are avoided, as the pit top is completely closed down during the greater part of the time. It will thus be seen that although the use of large engines may at one time have been of doubtful advantage there is no reason for doubting their advantages whenever the winding arrangements described are installed.

Investigation of the effects of fine grinding on cyanidation has resulted in instituting similar studies regarding amalgamation. It is doubtful, however, whether it will be found that fine grinding improves amalgamation. The consensus of opinion of experienced stamp mill men is that crushing finer than thirty or forty mesh hinders, rather than aids, amalgamation. On the other hand, a cyanide expert of prominence has recently stated that one of the discoveries resulting from fine grinding is that greater returns can be obtained on the plates from the slime product. The practice mentioned consists in flowing the pulp over ordinary silvered plates and then, after fine grinding, over shaking plates. While these opinions are widely different, they undoubtedly have foundation, and tend to show the necessity of individual treatment for individual ores.

THE ZINC DUTY.

The Daily News has it that a duty has been imposed on zinc sulphides entering the United States. It is well known that the agitation has been steadily kept alive by the Joplin producers, and only recently has the question been before the Attorney-General of the United States. The imposition will not hurt the producer in the Slocan. Its one effect will be to force the smelting of the ores in Canada, and the prices paid will be fully as high as those paid in the States. This in the face of the local plant not yet having time to perfect the practice. Once that is perfected and the costs known, the United States competition will never be missed.

It must be maddening to the Great Northern railway to have the effort to serve the United States market treated with so little sympathy. Just what they will do now in the way of providing markets for the zinc production in their territories is a problem. The Frank plant can now meet any competition and with the duty of 20 per cent can more than worst it.

The only other market available is Europe, and it cannot compare with Frank. The attitude of the local plant toward this production is one of indifference. If any proposition is made it must come from the Great Northern. There is plenty of zinc available, independent of that territory. The matter is up to the producers and the railway to scrap it out among themselves.

[Sandon Standard].

THE CASSIAR COAL FIELDS.

(By Our Special Correspondent).

One of the most promising of the hitherto unworked coal fields of British Columbia is to be found in the Telkwa Valley of the Cassiar District, where the Cassiar Coal Development Co. has 52 square miles, all of which, so far as investigation has gone, being underlaid with several seams of coal of excellent quality, and only waiting for transportation facilities to develop into an important industry. The line of the Grand Trunk Pacific Railway is expected to pass near to or through the property, while a charter also controlled by the G.T.P. exists for a road to Kitamaat Arm, 80 miles distant, a land locked harbour connecting with the Pacific Ocean.

The coal field was discovered in 1901, by Mr. William Limin when prospecting for gold and copper. In 1902 a party of qualified men, equipped with a diamond drill and other tools went in, and they have made a throrough examination, which shows the extent and richness of the deposit. Professor Coleman, of the School of Practical Science, Toronto, was sent out the same year, and his report fully bears out the results arrived at by the first explorers. He reached the following conclusions: Tat the coal is of good bituminous quality, burning well and

Seam No. 1.

standing the weather excellently, unlike lignite coals; that it is apparently of the same age and general character as the best coals mined on the Pacific slope; that seams of coal, from 3 to 15 feet thick, occur from point to point along the valley. In 1904 Mr. A. Webster, formerly of the Geological Survey, visited the locality, and in a letter to Mr. Limin and Mr. Davis his associate, says he considers it of the very first quality, both as a coking and a steam coal. "I have never," he says, "seen better coal in British Columbia." He gives a section of the strata in descending order as follows:—

	Feet
Ash, rock, drift, etc.	100
Top seam of coal (No. 1)	20
Clay shale	25
Coal seam (No. 2)	15
Clay shale	4
Coal seam (No. 3)	2½
Clay shale	40
Coal seam (No. 4)	4
Clay shale	35
Coal seam (No. 5)	14

Seam No. 2.

This gives a total thickness of coal over 50 feet. Allowing one million tons for each foot to the square mile the amount of coal in sight would be the enormous total of 25,100,000,000 tons. The company expect to mine 3,000,000 tons a year, so that the deposit would not be exhausted for nearly a thousand years.

The seams crop out on Goat and Mud Creeks, which are tributaries of the Telkwa. The latter flows into the Buckley which in turn empties into the Skeena near Hazelton, up to which point steamers ascend. From there supplies are taken in by pack train over a good trail. The Telkwa and Buckley Valleys are very fertile and a number of claims have been taken up, but until railway communication is established settlement will necessarily be slow. As an instance of the fertility of the soil Mr. Limin obtained from 5 sacks of potatoes planted as seed 150 sacks. Wheat, oats, barley, peas, and garden truck of all kinds grow readily. The elevation is about 2,000 feet above the sea.

Tests with the diamond drill show that the seams dip towards the north and east, and that there is considerable faulting. A hole near the northern boundary penetrated 130 feet into the overlying sandstone without reaching the coal, when operations had to be suspended by the breaking of the drill. The deposit is underlayed by conglomerate.

An interesting feature of the deposit is the ash beds which are found in some places. Fire seems to have eaten its way into the seams, probably from Indian camp fires, and having burned the coal the overlying rock has fallen down, smothering the fire and leaving the ash beds.

The only coal mined so far was for the use of the prospectors. They burned it for three months in a stove without having a

Seam No. 5.

clinker. Tests show that it is low in ash and sulphur. It is very solid and can be mined with little waste. There is plenty of timber and water on the spot, so necessary in coal mining operations.

The Cassiar Coal Development Co., which is composed principally of Toronto and Hamilton men, took out a license after the first discovery, and after development work had established the value of the deposit, obtained a lease. They are now negotiating with English capitalists for the sale of a large interest in the property. The latter have put up a deposit as a guarantee of good faith, and will close if the property comes up to representations when examined by their expert in the spring. Some stock was sold by the Cassiar Development Co., but none is now on the market. Some small claims have been aken up on adjoining properties.

The accompanying illustrations show seams Nos. 1, 2 and 5 where they are exposed on the banks of Goat Creek.

THE WORLD'S PETROLEUM SUPPLY.

The United States supplied more than one-half of the petroleum produced in the world in 1904. A statement of the world's production of petroleum, prepared by the British Board of Trade, which has just reached the Bureau of Statistics of the

Department of Commerce and Labor of the United States, puts the petroleum production of the world in 1904 at 9,303,000,000 gallons, of which 4,916,000,000 gallons werep roduced in the United States, 3,650,000,000 gallons in Russia, 202,500,000 gallons in Austria, 206,500,000 gallons in Java and Sumatra, 135,000,000 gallons in Roumania, 105,500,000 gallons in British India (principally Burma), 49,000,000 gallons in Japan, 20,000,000 gallons in Canada, and 18,500,000 gallons in Germany.

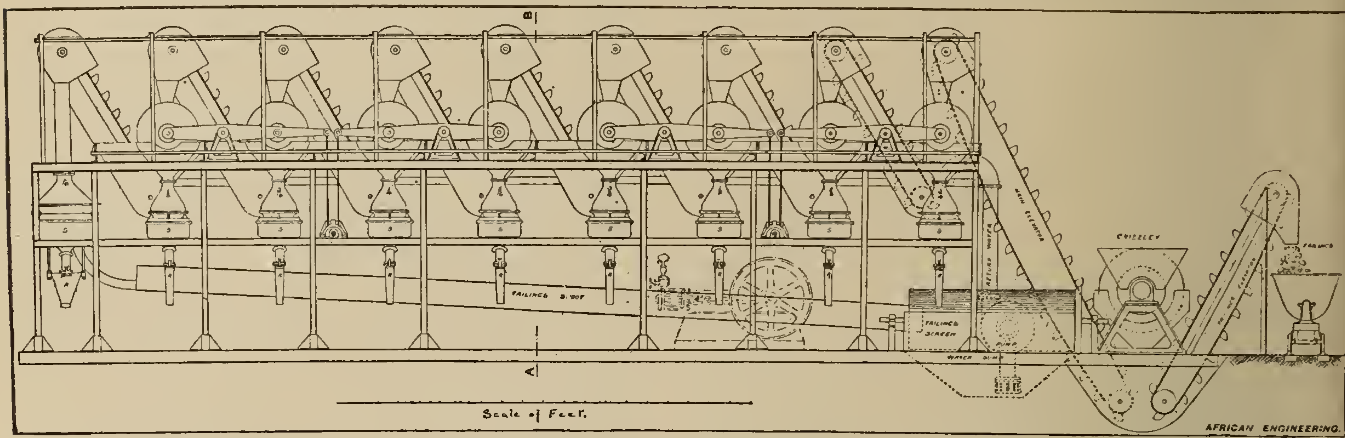
These figures give the grand total of 9,303,000,000 gallons of petroleum production in 1904, a total which far exceeds that of any earlier year. In 1903, which made the highest record of any year prior to 1904, the total was but 8,504,000,000; in 1902 it was 7,588,000,000. This increase in 1903 and 1904 occurs chiefly in the United States. The figures of production in the United States show an increase of about 697 million gallons in 1904 over the figures of 1903, while those of Russia, our chief competitor in oil production, show an increase of but 103 million gallons over 1903, and the increase in the United States in 1903 is also much larger than that of Russia. In the four years 1898, 1899, 1900, and 1901, Russian production of crude petroleum exceeded that of the United States, but in all other years for which the record is shown by the publication in question, extending from 1883 to 1904, the production of the United States exceeds that of Russia, and by far exceeds that of any other country. Indeed it may be said that the United States and Russia produce practically nine-tenths of the petroleum of the world, the total production in 1904, as above shown, being 9,303,000,000 gallons, of which 8,566,000,000 was produced ni the United States and Russia combined.

Exportation of illuminating oil, or kerosene as it is familiarly called, is also much greater from the United States than from Russia, especially as American crude oil gives a much larger per cent. of illuminating oil than does that of Russia. The total quantity of refined illuminating oil, exported from Russia in 1904 was 455 million gallons, and from the United States 761 million gallons. Russian exports go largely to southwestern Europe, northern Africa, and southern and eastern Asia, while western Europe, eastern Asia, Oceanica and North and South America are the most important markets of the United States. Of the 876 million gallons of refined oil of all classes (including naphthas and lubricating oil) exported from the United States in the calendar year 1904, 201 million gallons went to the United Kingdom, 117 millions to Germany, 112 millions to Netherlands, 41 millions to Belgium, 24 millions to France, 74 millions to other countries of Europe. In eastern Asia 70 million gallons went to China, 39 millions to Japan, and 24 millions to Hongkong, while 25 million gallons went also to southern Asia under the general title of British East Indies, and 26 million gallons to British Australasia. In America the distribution was to Brazil 20 million gallons, Argentine Republic 16 millions, British North America 19 millions, Chili 6 millions, Central America 2 millions, Cuba 2 millions, and Mexico 1 million.

Petroleum has formed of late years an important factor in the exportation of the United States. Prior to 1905 it was the largest single item in the statement of exports of manufactures, but in that year copper for the first time exceeded petroleum in the value of exports. The total value of all classes of iron and steel manufactures exported, of course, exceeds by far the total of petroleum, but no single item in the group entitled iron and steel manufactures is as large as the item of illuminating oil under the general head of refined mineral oil exported. The total value of iron and steel manufactures of all classes exported in the decade ending with 1905 was $943,886,511, of refined mineral oil $622,313,762, and copper and manufactures thereof $444,878,552, while the next largest item is leather, $272,534,562, and cotton manufactures, $259,136,044.—*Mining Reporter.*

WATER AS A DIAMOND CATCHER.

The vexed and extreme difficult problem of the automatic sorting of diamonds from the concentrates which leave the washing machines has had the close attention of engineers all over the world. It was not until the De Beers Company discovered, patented and made use of grease as a diamond catcher that it could be said that inventors had got any nearer to a solution of the problem. No one quite knows how it is that diamonds adhere to grease, while most other substances pass over the plates and escape its influence. That such is the case, however, has long since become an accepted fact, and the theory which attributes the action of the grease-catcher to adhesion or surface contact to be correct may be true. Certain it is that grease-plates catch 100 per cent. of the diamonds which are fed over their surface, and in this respect the system may be said to have attained perfection. Gravitation has nothing to do with the working of the grease diamond-catcher, but the concentrates, after leaving the washing machines, have been sorted roughly by gravitation in the pulsator before they arrive at the grease tables. In this machine, to be described, separation is effected by gravitation pure and simple, and the medium which operates it is water. It is claimed that this machine will render the use of the pulsator and grease-plate unnecessary. This, of course, would be the case if all the surrounding substances are of a smaller specific gravity than the diamonds. In practice, however, as far as South African concentrates are concerned, this is not so. If the mass of stones, etc., which fall within the range of the specific gravity of diamonds is so great as to render hand-sorting a tedious and expensive process, then the grease-catcher will still have to be resorted to. In that case the machine will merely take the place of the pulsator. Its advantages over



Eight Stage Diamond Separator for separating Concentrates, by the Automatic Gem and Gold Separator Syndicate, of London. Longitudinal Elevation.

this are that it possesses no moving parts, is subject to no wear and tear, and is far more compact and convenient. The machine in question is the invention of Mr. W. S. Lockhart, and is being introduced conjointly by the Automatic Gem and Gold-Separator Syndicate, of 10, St. Swithin's Lane, and the Pulsometer Engineering Company, of London and Reading, who are the manufacturers.

A glance at the line drawing will show that the plant consists of eight similar units, and a ninth of slightly different design. Each unit consists of a classifier and separator, and an elevating device connects each pair of units. The only difference between the several sections is that each is adjusted to deal with different-sized material. The number of units is not, of course, confined to eight, the number varying with local conditions.

The operation of the machine is as follows: The concentrates from the washing machines are dumped into the grizzley shown at the right hand of the drawing, and then picked up by the main elevator, unless the grizzley can be so arranged that the materials will gravitate to the machine. The elevator delivers into a hopper, from which the materials fall into the first classifier. The classifier consists of a drum, covered with wire clothing, or plates perforated with square holes. The perforations of the first drum will, in the instance under consideration, pass ¾-in. material and everything under. Within the classifier drum there is a fixed spiral. The drum is made to rotate, and given a shaking motion at the same time by means of the levers shown. This assists in puddling any clayey material that the washers may have passed. The oversize from the classifier finds its way out at the end of the drum into a revolving feeder, which delivers the materials in an even stream to the receiving hopper of the first separator below.

The separator is a simple contrivance. A stream of water is made to flow upwards in the annulus between two cylinders. The materials to be separated are fed into the annulus, at right angles to the stream of water, through a circumferential slit in the outer cylinder. The rate of flow of the water is adjusted until it carries all the matter of a less specific gravity than the diamonds with it, and discharges them into a tailings chute. The diamonds, together with any heavier matter, sink against the current of water, and are collected in the receptacles marked R. These are locked up, and can only be opened by someone in authority.

To return to the classifier and follow the course of the undersize from the first drum, which wlll all be of dimensions less than ¾-in, it is collected in a hopper below the first drum, and, in the instance shown in the illustration, taken thence to the second classifier by a bucket elevator. An improvement is, however, being introduced, in which this transference is also affected by a current of water—a much more simple and effective device. The drum of the second classifier is provided with ⅝-in. holes Hence the second separator only has to separate materials ranging in size from ⅝-in. to ¾-in. Everything below ⅝-in. passes on from the second to the third classifier, where a further selection takes place. This process is repeated in each of the eight units until the last unit has only to deal with ⅛-in. materials. The undersize from the eighth classifier is all passed through a large, ninth, separator, which acts as save-all, and secures any very small diamonds. The tailings from the several separators are collected in a common chute, or disposed of in any other convenient way. If the supply of water is limited, it can be strained out of the tailings and used over and over again, muddiness not being detrimental to the working of the machine.

The photograph which we reproduce shows a small plant, which has been installed to test the tailings from some pans used in washing for rubies. Two or three per cent. of the tailings from some pans used in washings for rubies. Two or three per cent. of the tailings are passed through the separator to show whether the pans are doing their work properly or not. The machine in question handles from six to eight tons a day.

It was on a machine very similar to this that the tests which we witnessed were carried out. Several diamonds were placed in a quantity of gravel. Each time this was passed through the separator all the diamonds were, without fail, extracted. Small nuggets of gold and alluvial tin were also separated from fine gravel with equal success, but the most remarkable test of all was made with gold dust. Two small particles of gold, so fine that they could only be picked up by wetting a finger, were placed in about a quart of silver-sand. This was passed through the machine at a good speed, yet both pieces of gold were recovered, and all surrounding matter was eliminated.

Several of these separators are in use in Brazil and elsewhere, but none as yet have found their way to South Africa.

[The foregoing interesting article appeared in *African Engineering*, and is reproduced in consequence of inquiries addressed to the REVIEW for apparatus which might be used in Canada. We think it also of interest to our readers generally interested in concentration methods.—Ed.]

REPORT OF THE DOMINION COAL COMPANY, LIMITED.

The Directors' report for the year ending Dec. 31, 1905 was as follows:—

The output of 1905 was 3,189,657 tons, as compared with 3,023,522 tons for 1904.

The net earnings from the operation of the Company's mines, steamships, railway, stores, rents, etc., for the year 1905 were $1,573,832.19, as compared with $1,620,475.33 for the year 1904.

The general business of the Company during 1905 was well up to the standard of 1904, but the largely increased requirements of the Dominion Iron and Steel Company necessitated an increased output from the mines, and as the contract with that Company is not at present a remunerative one, the average price realized from sales in 1905 was consequently less than in 1904. The decrease in net earnings shown above would, however, have been greater but that the operating expenses, outside actual cost of mining, were considerably reduced.

The surplus earnings, after providing for interest on bonds, preferred stock dividend, etc., have been added to the Company's general surplus, against which account have been charged expenses of reorganizing the Company's securities and an amount to represent depreciation in value of merchandise in the Company's stores.

DEVELOPMENT WORK.—Steady progress has been made with the opening and equipment of the new mine known as Dominion No. 6 on the *Phelan Seam*, and a substantial daily output will be obtained from this mine after the opening of the St. Lawrence navigation this year.

The *Emery Seam* is now being worked through the old workings at Dominion No. 5 (Reserve); shafts are also being sunk to this seam at Reserve and at Dominion No. 6, and it is expected that by the opening of navigation the work will be so far advanced that this seam will yield an output of about one thousand tons per day.

Development work at the other mines has been continuously carried on and is now well in advance of the workings.

Contracts for an electric plant situated at Dominion No. 2 have been let. This plant will be used for furnishing the auxiliary power required at the mines for pumping, ventilation and underground haulage, etc. The general adoption of shearing machines and the increased requirements of the coal cutting machines will practically exhaust the capacity of the compressed air plants at the different mines leaving such auxiliary requirements unprovided for. The central electric plant is needed to make good this deficiency, and will also carry out the work more economically than under present conditions.

Your Directors recognizing that an ample equipment of rolling stock, particularly cars, is a necessity for rapid delivery, for avoiding delays to ships and for saving in operating expenses generally, decided this year to purchase one hundred and fifty 50-ton steel cars at a cost of $162,000. The greater number of the Company's wooden cars have been remodelled and practically rebuilt in the Company's own shops, and this part of the equipment is now in a thoroughly efficient and serviceable condition; this repair work has been charged to operating expenses.

The total amount expended during the year 1905 on *capital account*, including the above purchase of steel cars, is $497,605.19.

All other development work, renewals and repairs have been charged against operation.

FINANCIAL POSITION.—It will be noticed from a perusal of the annexed balance sheet, that the Company's financial position has greatly improved during the year 1905. In May of that year the Shareholders gave their approval to a scheme for the re-arrangement and consolidation of the indebtedness of the Company, the main features of which were the substitution of an issue of $5,000,000 5% Bonds in place of the outstanding $2,435,000 6% Bonds, and $2,380,000 Time Notes; and the substitution of an issue of $3,000,000 7% Preferred Stock in place of a like amount of 8% Preferred Stock. These changes, which, besides other advantages, will effect a large saving in fixed charges, necessitated a considerable outlay in premiums on old securities redeemed and other expenses, which amount your Directors have written off from the general surplus.

GENERAL.—The Company has laid before its employees a scheme for the purchase of their homes on the instalment plan, such as exists at other collieries in this country and abroad, and it is expected that this will be largely taken advantage of by the men. The workmen will gain thereby in becoming owners of their houses on paying a little more than their present monthly rent, while it is hoped the Company will also gain by securing the services of a steady, permanent body of employees.

Your Directors, following a well defined plan for future operations, have, during the year 1905, made large expenditures for necessary equipment and for development to provide for the natural exhaustion of the older workings, and in order to continue this programme it will be necessary to make similar expenditures in 1906. It may, however, be pointed out that in so far as these expenditures are chargeable to capital account the amount so expended to the extent of 75 per cent of the outlay may, if deemed advisable, be subsequently capitalized (after 1st November, 1906) by issuing the additional $2,000,000 First Mortgage Bonds or any part thereof at present retained in the Company's treasury. Meantime, your Directors have considered it the wiser policy to postpone payment of dividend on the common stock for the present. They trust that the Shareholders will approve these conservative measures, which, in wiping off the floating debt and providing liberally for the efficient equipment and development of the mines, remove impediments to the distribution of future profits; and these, setting aside the possibility of unforeseen accidents, may confidently be anticipated to result from the continued prosperity of the Company's operations.

Respectfully submitted,

JAMES ROSS,
President.

BALANCE SHEET

AS AT DECEMBER 31st, 1905 (compared with Dec. 31st, 1904).

BALANCES.	For Year Ending Dec. 31, 1904.		For Year Ending Dec. 31, 1905.	
ASSETS:				
Property Account as per last Report	22,600,597.83		22,970,516.00	
Less				
Written off for Depreciation	130,569.81		144,844.60	
	22,470,028.02		22,825,671.40	
Add Capital Expenditure since	500,487.98	22,970,516.00	497,605.19	23,323,276.59
Cash in Banks and Offices	151,746.73		251,550.82	
Accounts Receivable	702,360.50		825,083.70	
Coal on hand	262,715.52		302,400.46	
New Supplies in Stores and Warehouses	795,928.76		763,257.09	
Insurance paid in advance	31, 692.52		19,360.98	
Steamship Hire paid in advance	35,620.90		22,234.87	
Cash and securities in New England Trust Company for Sinking Fund	261,966.84			
Securities of other Companies	191,000.63	2,433,032.40	189,964.63	2,373,852.55
		25,403,548.40		25,697,129.14
LIABILITIES:				
Capital Stock, Common	15,000,000.00		15,000,000.00	
" " Preferred	3,000,000.00		3,000,000.00	
SpFirst Mortgage Bonds	2,435,000.00		5,000,000.00	
Mortgages	72,000.00		72,000.00	
ape Breton Real Estate Debentures	394,421.58		353,785.08	
Cominion Rolling Stock Debentures	298,559.47		265,413.46	
Amount payable Dominion Steel Co.	2,380,000.00	23,579,981.05		23,691,198.54
Accrued Dividend—Preferred	120,000.00		87,500.00	
Unpaid Royalty	84,056.62		97,833.12	
Accounts Payable	200,937.56		311,222.77	
Notes Payable	71,000.00			
Bond Interest, Accrued	58,250.00		41,666.66	
Contingent Fund	54,915.66		73,583.31	
Sinking Fund, Accrued	117,157.10	706,316.94		611,805.86
SURPLUS:				
Balance from previous years	226,912.13		1,117,250.41	
For current year	890,338.28	1,117,250.41	1,023,671.38	
			2,140,921.79	
Less				
Written off to provide for reorganisation of Securities and depreciation in value of Merchandise in Stores			746,797.05	1,394,124.74
		25,403,548.40		25,697,129.14

PROFIT & LOSS ACCOUNT

FOR YEAR 1905 (compared with 1904)

	For Year Ending Dec. 31, 1904		For Year Ending Dec. 31, 1905	
Net Proceeds from Sale of Coal and Net Income from Steamships, Railway, Stores, Real Estate, etc		1,620,475.33		1,573,832.19
Less				
Interest on Bonds	148,818.16		212,249.73	
Dividend on Preferred Stock	240,000.00		220,916.04	
Misc. Interest and Premium on Bonds retired	202,996.24		96,679.94	
Sinking Fund under former Trust Deed	138,322.65	730,137.05	20,315.10	550,160.81
		890,338.28		1,023,671.38

Certified correct,

J. R. BLACKETT,
Auditor.

THE STATIONARY ENGINEERS OF ONTARIO.

The Stationary Engineers of Ontario, who number in the vicinity of 10,000, are petitioning the Ontario Government for an amendment to their present Act, making certificates necessary in the interests of public safety. The amendment suggested has taken the form of the following draft bill, which the Society of Stationary Engineers request us to publish:—

An amendment to an Act respecting Stationary Engineers, Victoria 54, Chapter 141, Revised Statutes, 1897, Chapter 31, annual 1891.

By and with the consent of the Lieut.-Governor-in-Council, and by and with the advice and consent of the Legislative Assembly of the Province of Ontario, be it enacted that this Act be amended by expunging all of it up to the words "casting vote" in section 13 thereof, and the following be inserted in lieu thereof:

1. The Lieut.-Governor-in-Council appoint a board consisting of a chairman and —— members for the purpose of examining applicants and granting of certificates to all persons operating steam boilers of 50 horsepower or over.

2. It shall be unlawful for any person to operate any boiler of 50 horsepower or over unless he has a certificate, granted under the provisions of this Act.

3. It shall be unlawful for any person to employ an engineer to take charge of a boiler of 50 horse power or over unless such person holds a certificate under the provisions of the Act, and any person who shall be guilty of operating, or any employer who shall employ any person to operate, a boiler contrary to this Act, shall be deemed to have committed a misdemeanor and shall, upon conviction, be fined not less than ——dollars and not more than —— dollars for each offence.

4. Every engineer who shall be in charge of any steam plant coming under the provisions of this Act at the time it comes into force or any engineer who has had two years' experience and who applies before the expiry of one year, shall, upon proving his character and upon paying the prescribed fee, receive a certificate for the term of two years, and such certificate must be renewed from time to time as it expires, provided, however, the Board shall have power to revoke any certificate upon proof of incapacity, drunkenness, or improper conduct.

5. Any person who feels himself aggrieved by the decision of the Board of Examiners, shall have the right (upon notice being given to that effect) to appeal to the Minister of Agriculture.

6. All candidates for certificates, except as provided for in section 4, shall furnish evidence of their good character, and of having at least three years' experience, either as assistants in an engine room, or boiler room, or as having full charge, and shall submit to such examination, written or oral, as the Board may determine.

7. All certificates shall at all times be exposed to view in some conspicuous place in the boiler or engine room, and the failure to expose same will be prima facie evidence of the lack of qualification under the Act.

8. All fees for examination shall not exceed $ —— and all renewal fees shall not exceed $——.

The London *Economist*, under the date of January 27th, prints a very interesting letter from Mr. F. W. Rolt, at one time of Rossland, and lately a director in the Le Roi Mining Company. Mr. Rolt's letter puts the position of the deposed directors in a clearer light than the REVIEW has seen it hitherto, and for the information of our readers we give it below in full:—

SIR.—The affairs of the Le Roi Mining Company have recently been the subject of much bitter discussion, in which, as you pointed out in a recent article (December 30th) the real issues were entirely lost sight of. But, inasmuch as large sums of English money have been invested in this and other mines in the Rossland District, a few remarks on the position of affairs in that camp may be of interest to many of our readers.

The two principal English properties in the Rossland camp are, as you are aware, the Le Roi and the Le Roi No. 2. A comparison of the record of these two companies during the past four years shows the following results. During that period it must be explained that the Le Roi mine has been worked to produce a comparatively large tonnage of low grade ore, while Le Roi No. 2 has made small shipments of ore of much higher value. The following table gives the results in detail:—

	LE ROI		LE ROI No. 2	
	Total Shipments	Gross Value of Ore	Total Shipments	Gross Value of Ore
Year	Tons	$	Tons	$
1904-5	114,959	12.41	12,337	35.78
1903-4	160,109	10.94	21,680	24.80
			1,340	10.00
1902-3	182,669	13.36	17,550	20.69
1901-2	155,765	11.70	63,261	16.89

During the same period the profit and loss balances are as follows:—

Year		Le Roi £		Le Roi 2 £
1904-5	+	49,741	+	29,810
1903-4	—	88,194	+	25,819
1902-3	+	80,242	+	6,208
1901-2	—	46,551	+	44,986

Result of four year's working by Le Roi Company Loss . . . £ 4,762

Result of four years' working by Le Roi No. 2 Company Profit . . . £106,823

It is not desirable or necessary to attempt here any comparison of the relative value or merits of the two properties, and for the purposes of this argument it will be sufficient to say that the Le Roi mine has generally been, and is still regarded as at least the equal of the Le Roi No. 2 property. This much being admitted, one is naturally prompted to enquire why the results obtained by Le Roi have been so disappointing, while those obtained by Le Roi No. 2 have been so satisfactory. The explanation is to be found in the fact set forth above, that the Le Roi has been worked as a big low-grade property and Le Roi No. 2 by means of close hand-sorting, as a small high-grade one. The further question at once arises—Why this difference of method? Why has the system that has brought success to Le Roi No. 2 not been adopted by Le Roi? The explanation again is simple. The Le Roi No. 2 Company does not own its own smelter, and therefore disposes of its ore to the best bidder, after first eliminating all unprofitable ore by close hand-sorting. The Le Roi Company owns its own smelter, and during the period under discussion has used it to smelt its ores, with the following results. It may be taken for granted that no smelter in the Rossland district can be operated with anything like reasonable economy upon less than 300 to 350 tons of ore per day. This is a minimum, and as a matter of fact the amount has often been greatly exceeded in the Le Roi Mining Company's smelter at Northport. In order to obtain the necessary supply of ore the Le Roi Company had to rely firstly on the output of its own mine, and, secondly, to a much smaller extent, on "customs" ore bought from other mines. The second source of supply has long been recognized as most important, and great efforts have been made to develop this branch of the industry. But for the very good and sufficient reason that the operating costs of the Northport smelter have always been too high, it has been found impossible to compete successfully with other smelters in the district, so that the amount of customs ore purchased from other mines has always been small, and during the year 1904-5 amounted to less than 10,000 tons. Thus the Company has been thrown back upon its own mine, and in order to keep its own smelter going has been forced to ship large quantities of ore of less than payable grade. Owing to the very serious mistakes in sampling which were made during the year 1903-4, and which were at the time the subject of much discussion, it is impossible to examine the shipments for that year. But an analysis of the shipments for the year 1904-5 amply proves the strength of the above assertion. During that period the mine shipments to the Northport smelter amounted to 114,959 tons, of which at least 50,000 tons were of a lower value than the total monthly working expenses: that term including cost of mining, depreciation, office expenses, and direct and indirect smelting charges, but excluding cost of development. In other words, during the year ending June 30th, 1905, almost exactly one-half of the total shipments of the Le Roi mine resulted in a dead loss to the Company, and were made for no other purpose than to supply their own smelter with the minimum amount of ore required for its operation. In the face of these figures, no other conclusion is possible than that the Le Roi Company should for the future follow the policy of the Le Roi No. 2, which would involve much more careful sorting, reduction of shipments and increase of the average value of its ore. The adoption of this policy necessarily carries with it the relinquishing of smelting at Northport, which it is not amiss to remark was the decision arrived at and carried out by the late board of Directors. One further conclusion is to be drawn from the facts and figures given above. It is this, that the output at Rossland camp has never at any time been sufficient to maintain in full and economical working more than one smelter, and that the poor record of the camp is due not to the poverty of the mines but to the insane policy which has been followed of scattering its output all over the country instead of pouring it into one smelter where, because it could be treated on a large scale, the greatest possible economies could be effected. The consolidation proposals put forward by the late Board of Directors would, to a very great extent, have attained this result, and were, therefore, from this point of view at all events a move in the right direction.

Yours faithfully,

F. W. ROLT,

(Late Director Le Roi Mining Co.)

January 26th, 1906.

JHELUM RIVER HYDRO-ELECTRIC POWER INSTALLATION IN BRITISH INDIA.

The Government of British India has for some time pursued a broad-minded policy in developing the latent possibilities of the immense and valuable country over which it exercises sovereignty and its officials have interested themselves in providing for the future welfare and enlightenment of the native inhabitants. Among other laudable projects, which the Government has instituted, has been the commissioning of some of the most capable Royal Engineers to plan for and construct public works, such as would aid in the general advancement of the native industries and the development of the commerce of the country.

The first notable project undertaken for the generation and distribution of electricity was that of the Cauvery Power Scheme, located in Mysore State in Southern India. Work on this plant was started in 1900, the initial installation being completed after many difficulties in June, 1902. About a year ago, the second installation or extension of the plant, consisting of 3610 kilowatts generator capacity, was completed. This increased the possible output of the entire plant to 7920 kw, making it the largest hydro-electric installation now operating in Southern Asia, if not on the entire continent.

The chief credit for the completion of the Cauvery Power Plant is due to Major A. J. de Lotbiniere, R.E., Deputy Chief Engineer of the Government of Mysore, who not only conceived the plan of the installation, but successfully arranged for the financing of the entire project, overcoming prejudices that would have deterred a man less sound in his convictions. He afterwards arranged for the purchase of the entire electrical and hydraulic equipment and supervised its installation.

The power scheme next to be undertaken after the Cauvery is the Jhelum Power Installation on the Jhelum River in Kashmir, in Northwest India. This power plant is to be installed near Rampur about 50 miles below Srinager, where a 6-mile conduit will give a head of water at the plant of about 400 feet. The present plans call for an installation of about 20,000 horsepower.

It is planned to use the power for operating the Kashmir section of the Jhelum Valley Railway electrically along its entire length of 180 miles. A single-phase system of traction will undoubtedly be installed. Possibly the most important immediate use to which the power will be put will be in operating dredgers for the purpose of deepening the Jhelum River in the Kashmir Valley, and thus minimizing the floods, which, under existing circumstances, periodically devastate the entire country. The contemplated plant will also allow of the reclamation of a very large tract of land, and permit of the storage of water in Wular Lake above the power plant for sale to the Punjab Irrigation Department. Another important use of the power will be for operating the large silk factory at Srinager and also for supplying with current the electrical water heaters in the silk mill. In addition, the power will be utilized for other industrial purposes and for lighting in Srinager and in Abbottabad. Murree and Rawalpindi, prosperous towns in the British Province of Hazara, lying to the west of Kashmir.

After successfully completing the preliminary arrangement for carrying on the important work connected with the Jhelum Power Installation, Major de Lotbiniere was instructed last May, by the Jammu and Kashmir State Council, acting for the Maharajah of Jammu and Kashmir, to proceed to Europe and America in order to interview the leading hydraulic and electrical manufacturers and to ask those selected to bid upon the machinery and materials for the plant. Carrying out these instructions, he visited the works of those leading manufacturers on both continents who were considered for the work and personally inspected their manufacturing establishments, as well as power plants in which their machinery was operating.

As a result of this careful investigation, Major de Lotbiniere, who had full powers for the acceptance of the tenders submitted, has recommended to his Government that the contracts for the entire hydraulic and electrical equipment be placed with firms in the United States. The contract for the hydraulic equipment was awarded to the Abner Doble Company of San Francisco, U.S.A., and calls for the hydraulic plant complete from the forebay to the tailrace, including the intake, valves, pressure pipes, pressure-pipe thrust blocks, interior piping, water wheels and nozzles, hydraulic governors, and all details necessary for the hydraulic equipment. The apparatus and materials are to be delivered at the Port of Karachi, India.

The gravity conduit line for the power plant will be approximately 34,000 feet in length and for the upper 8,500 feet will consist of an excavated ditch lined with masonry. The remaining portion of the water channel will consist of a rectangular flume, or a wooden stave pipe such as has been installed so successfully in connection with plants of this character on the Pacific Coast. The flume will have a capacity of over 500 cubic feet per second.

The forebay at the end of the gravity line and at the head of the pressure pipes will be constructed of masonry and will be provided with special headgates. The sliding elements of the intake gates will be of timber, all iron and metal parts necessary for the construction of the gates being furnished by the hydraulic contractor.

The pressure lines will consist of riveted steel pipes designed with a factor of safety of five, each supplying one of the hydro-electric units. For each pipe line a standpipe and two special vacuum valves will be provided in order to protect the pipe against injury in case the water should be drawn out suddenly.

At the lower end of each pressure line the last length of pipe will terminate in a flange which will be bolted to a massive cast-iron thrust block that will rest on a heavy cast-iron sole plate or base. The latter will be mounted on a substantial masonry foundation and held in position by anchor bolts. This fitting will be designed to take the entire hydraulic thrust of the pipe, an ample factor of safety being allowed so that under the most severe conditions there will be no strain on the branch piping in the interior of the power house. Each pressure line will consist of a riveted steel pipe varying in diameter from 30 to 36 inches and a 54 to 36-inch taper pipe, 10 feet long, at the upper end. The pipes will be 790 feet in length, and will deliver the water under an effective head of 400 feet.

The interior piping of the power house will consist of welded pipe with welded flanges, all piping and fittings beyond the thrust block being designed with a factor of safety of 10 and subjected to a test pressure of 1½ times the working pressure for a period of five hours.

Twelve main units and three exciter units have been planned for the equipment of the power house. Each main unit will consist of a Doble Tangential Water Wheel with automatic oil-pressure governor delivering 1,765 brake horsepower to the shaft, under an effective head of 400 feet. Each wheel will be direct connected to a 1,000-kw alternator, the speed of the unit being 500 revolutions per minute. The exciter units will each consist of a Doble Tangential Water Wheel delivering 285 brake horsepower to the shaft under an effective head of 400 feet. The speed of the exciters will also be 500 revolutions per minute.

The hydro-electric units will be of the Doble standard two-bearing type, the wheel runner being fastened on the end of the shaft. For each of the main units the Doble Company will furnish a high-carbon, open-hearth steel forged shaft and two bearings of a special ring-oiling type provided with revolvable bearing shells. The exciter water-wheel runners will be mounted on the extended ends of the exciter generator shafts.

The water wheels will be equipped with ellipsoidal buckets' needle regulating nozzles and centrifugal water guards. The regulation of the main units will be effected by means of hydraulic governors operating jet deflectors. For the exciter units hand regulation will be provided by means of the needle nozzles. The gate valves for each wheel will be of special construction with outside screw and yoke, bronze-mounted, with by-pass.

The power house will be of solid masonry construction and will have a wide veranda as a protection from the tropical sun. A double steel roof will be provided and two travelling cranes will be installed for handling the machinery. The transformers will be installed in a bay of the main building or in a separate structure.

The conditions under which the plant will be installed are decidedly out of the ordinary as compared with similar work in this country. The specifications for the electrical and hydraulic equipment stipulated that no single piece of machinery should weigh more than four tons when packed, for the reason that there is 200 miles of road transportation, including a lift over a range of mountains 8,000 feet high. Transportation in that section of the country is limited to bullock cart, and no single piece of machinery heavier than 4 tons can be transported, a total of 5 tons including the trollie (cart) being the maximum weight that can be hauled over the mountains.

Portland cement costs $7.50 per barrel delivered at the site, making its use prohibitive for heavy concrete work. However, there is plenty of natural rock in the vicinity, so masonry construction will be used for the walls of the power house and for the foundations of machines, intake, forebay, etc.

The entire hydro-electric installation will be constructed, erected, tested and placed in operation under the supervision of Major A. J. de Lotbiniere, R.E. Major D. Fraser, R.E., and Capt. Thomson, R.E., will act as his engineering representatives in London. Mr. A. C. Jewett, formerly of the General Electric Company, will serve as installing engineer for the Government. Mr. Jewett was connected with the installation of the Cauvery plant, and his selection as erecting engineer for the Jhelum River installation comes as a well-deserved recognition of his ability.—[Ad.]

A NOVEL WATERHOIST.

The question of unwatering a mine always is a serious problem to the mine management, especially so when the water is highly impregnated with acids. When the amount becomes excessive the means to be employed for disposing of it taxes the ingenuity of all concerned to the uttermost.

In the anthracite regions there are mines in which for every ton of coal raised, as high as 14 tons of water must be pumped, and the latter must be done at a minimum of expense. Nowhere, probably have a greater variety of pumps and lifting devices been tried—and the most satisfactory type, up to date, for handling large quantities of water at comparatively low heads, have proved to be large bailers operated by steam engines. These, however, lack the mechanical regularity inherent in a pump, as they are necessarily operated by men, and it remained for the Deleware, Lackawanna & Western R.R. Co. and its Electrical Engineer, Mr. H. M. Warren, to finally develop a water-hoisting equipment which would preserve all the valuable points of the steam hoist and at the same time operate automatically. The carrying out of the mechanical details of the hoist and its automatic devices were confided to The Wellman-Seaver-Morgan Company, of Cleveland, Ohio, and the successful operation of the plant reflects great credit on the latter, as they guaranteed the machiney to accomplish the desired results. Most of the electrical controlling devices were furnished by the Electric Controller & Supply Company, Cleveland, O. In the original specifications the D.L. & W.R.R. Co., called for the hoist to be operated by an alternating current motor of 800 H.P., and the question of starting, stopping and reversing so large a motor had, at the outset, to be met. The duty to be performed by the hoist, called for the raising of 4,000 gallons of water per minute to a height of 550 feet.

4,000 gals. x 8.27=33,180 lbs.
550′ 2″ rope x 6.3=3,465

36,645 lbs. to be raised at 550′ per minute.

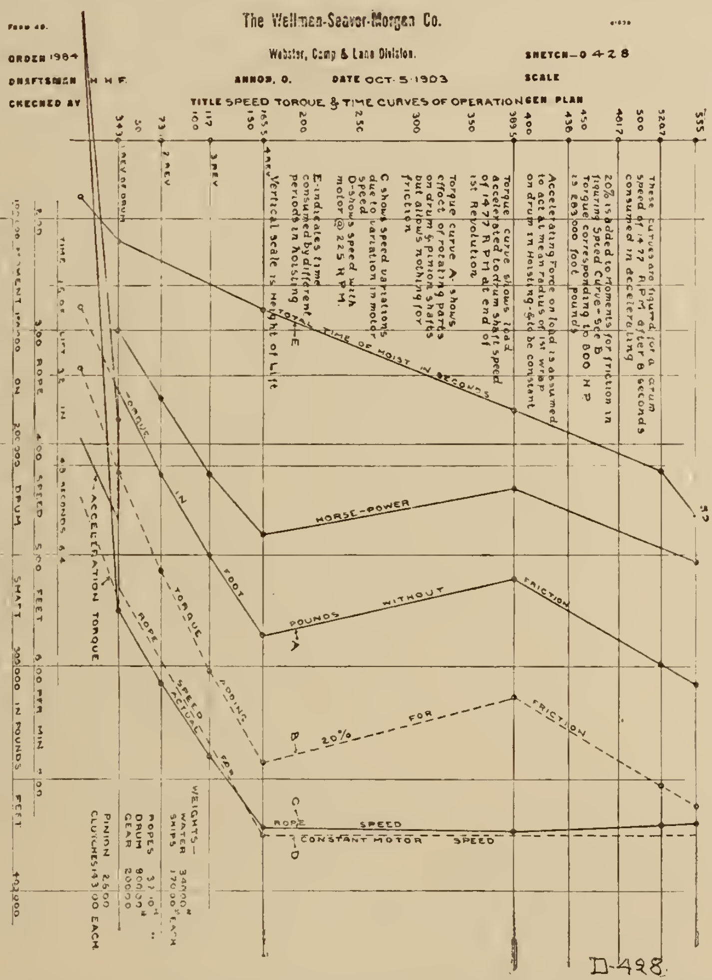
$$\frac{36{,}645 \times 550}{33{,}000} = 610 \text{ net horse power.}$$

Weight of bucket=½ weight of water, so that weight on rope=53,235 lbs. or nearly 27 tons requiring 2″ steel rope. The various preliminary speed and movement diagrams are laid out per accompanying diagram.

It was decided in carrying out the design that it would be impracticable to design the hoist other than have a motor running continuously in one direction, as it is a well-known fact that the amount of current required to accelerate a large motor of this type is enormous, and greatly interferes with the proper running of the power plant.

The D.L. & W.R.R. Co., desired to use an A.C. Motor directly at the hoist, and as the motor was to run continuously in one direction, this necessitated the use of friction clutches for accelerating and reversing the load. As The Wellman-Seaver-Morgan Company had several smaller plants already in operation using A.C. Motors on hoists which are operated similarly to the present hoist, and as they are running successfully, and the repairs and renewals for clutches had not exceeded that required for the other hoisting engines, it was decided to use this method.

Figs. 1 and 2 show a front and side view of the hoist. As will be noticed the general arrangement consists of a motor driving a pair of bevel wheels through a single bevel pinion. The bevel wheels run loose on a shaft and are fitted with the well known Webster, Camp & Lane friction clutches. The operating mechanisms for the clutches are so designed that only one clutch can be thrown in at a time, but both clutches can be out at the same time. Throwing in one clutch runs the drum in one direction; throwing in the other clutch reverses the motion of the drum.



To the shaft on which the bevel wheels run there is keyed a pinion meshing with main gear on the drum shaft. The drums are of the cylindroconical type 10′ at the small diameter and 16′ at the large diameter. At a hoisting speed of 550′ per minute the drum makes about 15 RPM. There is one main brake located between the drums. All of the clutches and brakes are operated by auxiliary air cylinders fitted with oil cushion cylinders, the compressed air being furnished by a motor driven air compressor and the necessary tanks located near to the hoist. The hoist is controlled by a mechanical device shown in Fig. 2. This device consists mainly of a drum rotated by means of a friction drive from the motor through a sprocket chain. The drum shaft transmits its motion to a secondary shaft fitted

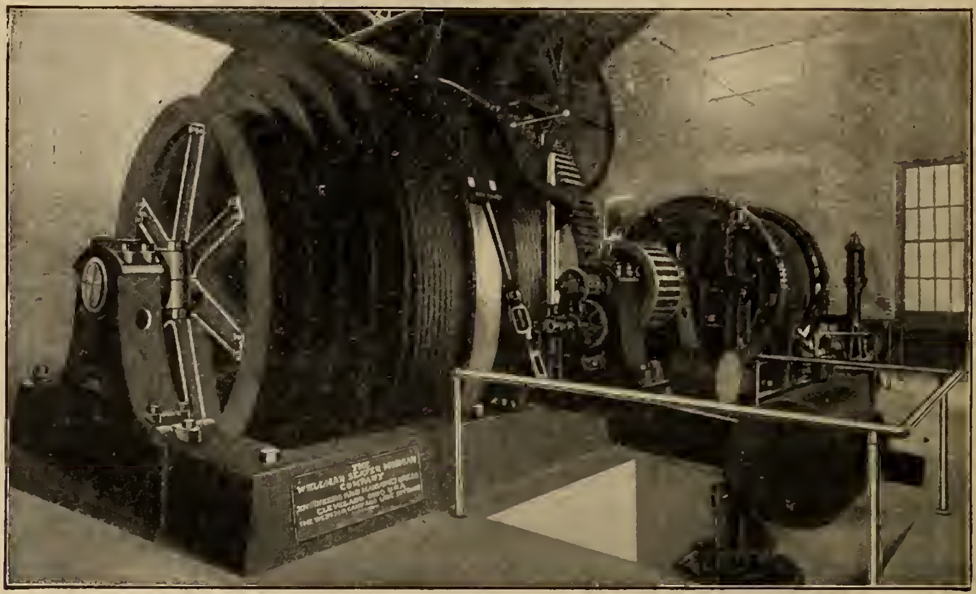


Fig. 1.

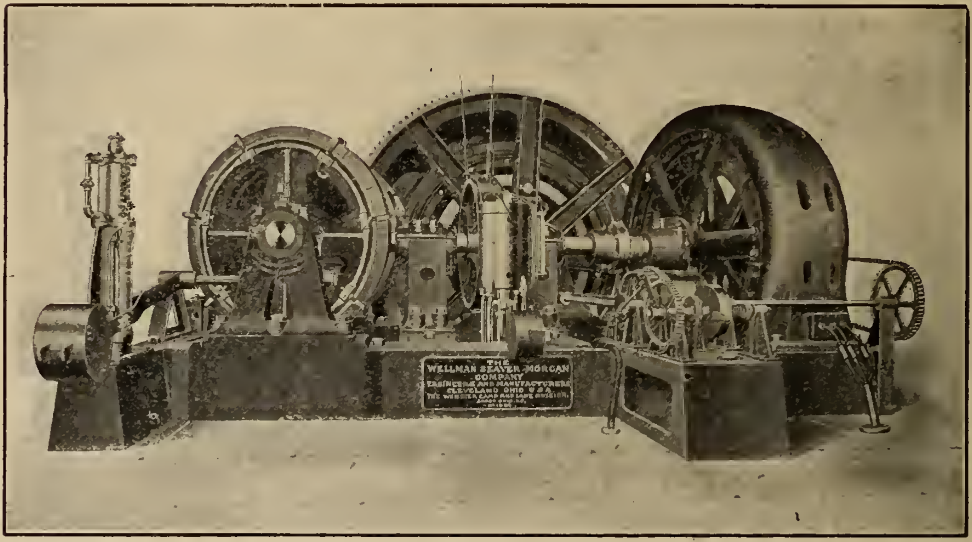


Fig. 2.

Fig. 3.

with variable speed which in turn operates a secondary stop. The main hoisting drum shaft operates a travelling nut which is so located with respect to the controller drum that at either end of its travel it releases a stop and allows the controller drum to make a quarter turn; this movement, through suitable electrical connections, operates the solenoids on the clutch valve, releasing the clutch and the solenoid on the brake valve setting the brake, the further movement of the controlling drum being arrested by the secondary stop. This stop is released by the variable speed shaft and its connections, which has been given a predetermined time movement corresponding to the interval for emptying the bucket. The further movement of the controlling drum releases the brake and throws in the reversing clutch, thus starting the hoist in the opposite direction, and also starting the travelling nut on the controlling mechanism in the opposite direction. At the end of the hoist the cycle of controlling movements in repeated and so on, making the hoisting operation continuous and automatic. Every attention has been given to the safe operation of the hoist. The main brake is of the gravity type and to be released the current must be on the solenoid operating the valve so that air can be admitted to the underside of the brake piston.

If for any reason, either the supply of current or of air pressure is interrupted, the valve drops, and the weights on brake lever set the brake. The clutches are designed so that they are thrown out by weights. As is the case with the brake, either clutch can only be thrown in when the current is on the solenoid, and the air pressure admitted under the piston, and if either current or pressure fail, the clutch is off. The motor shaft is fitted with an emergency brake operated by a weight controlled by a solenoid—any interruption in the flow of current to the motor sets the brake and stops the motor. Any interruption of the flow of the current stops the machine, throws out the

Fig. 4.

clutches and puts on the brake. A safety cut-out is provided for in the head frame so that in case a bucket is carried beyond the proper height, the current is cut off. Fig. 3 shows the head frame. The head frame is 93′ from the base to the centre of the sheave at the top. It is built of structural steel, roughly in the shape of an "A". From the head frame are suspended two buckets 6′ in diameter and 19′ 6″ deep. The capacity of each bucket is 17 tons of water. In the bottom of the bucket are located two lift gates with an area practically equal to the cross section of the bucket. These gates are lifted automatically when the bucket reaches the top, and the water is discharged through the bottom into a spout fitted below the bucket, and which deflects it to either side of the shaft. Each bucket makes a complete round-trip in one minute and fifty seconds, the total lift being 555 feet.

Fig. 4 shows a nearer view of the bucket when discharging. —[Ad.]

GIGANTIC TESTING MACHINE.

Messrs. W. & T. Avery Limited of the Soho Foundry, Birmingham have now under construction for the Engineering Section of the Birmingham University a huge machine for testing whole members of constructional work, such as complete Girders, Columns, Roof Principals, and every part in the construction of Bridges, Roofs and Machinery, in fact, the Machine will test any and every part that can possibly be used in Engineering Work.

The Machine is designed to test specimens for Tension, Compression and Transversely. The maximum capacity is 300 tons, the total length 70-ft. and the weight of the metal in the Machine is about 85-tons.

The strain is applied by an Hydraulic Cylinder & Ram and is arranged to test speciment in tension up to 25-ft., in Compression up to 30-ft., and Transversely up to 20-ft. in length.

The Machine is one of the largest Testing Machines that has ever been made, and is specially comprehensive in order to give a wide range of Tests, It is so arranged that an official can govern, from one position, the Hydraulic Power applying the strain, and the Recording Steelyard.

The Machine will be a great acquisition to the University.

A CLOSE VIEW OF THE WALKING DELEGATE.

What he does and how he does it described in the Coal-Mine workers.

A rather unusual view of the work of the "walking delegate" is presented by Frank Julian Warne in his book, "The Coal-mine Workers." just published by Longmans, Green, & Co. Dr. Warne says:

Nearly all the members of the executive board of the United Mine Workers of America are employed by the president of that organization as national organizers. As such they receive $4.00 a day and expenses. These are the "walking delegates". They bear the brunt of the fight, are always to be found in the thickest of it, and generally constitute the advance guard of the field force of the organization when an invasion of territory heretofore unorganized is decided upon.

They are the missionaries of the new doctrine as to the rights of man; they usually are compelled to blaze it forth to their kind in a wilderness of conflicting passions and class and race hatreds; they are met with suspicion and bitter antagonism even from those they would save from industrial servitude. These organizers are of many tongues; they go among strange peoples from many climes. They teach their doctrine of unionism alike to the negro, the Slav, the Lithuanian, the Greek, the German, the Englishman, and the American. Through months and even years of bitter antagonism, of almost crushing opposition, they work patiently at their task to bring the many nationalities engaged in coal mining into the organization, and to mould the heterogeneous mass into unity of belief and action. Fearless and undaunted by opposition, they bear persecution and suffer imprisonment and even death for the faith that is in them.

However far apart one's views may be from an endorsement of the means and methods employed by these organizers, if he could but see the spirit of martyrdom often exhibited by them he would believe, as the writer does, that they are performing a real and lasting work as pioneers in the formation of our industrial state.

In 1904 over sixty, and in 1905 more than sixty-five, organizers and field workers were employed by the national uinon in addition to the members of the executive board, making what is probabley the largest paid force of organizers of any labor union in the world.

These organizers, going into coal fields whose mine workers are outside the national union, begin their task by getting into personal touch with the men. They stop them on the street corners, visit the places in which they are in the habit of congregating, distribute among them tracts containing information about the organization, and in various other ways plant the idea of unionism in the minds of a few of the men. From these few it spreads, at first almost unobservable, until gradually the workers begin talking about "the union", and by degrees nearly all the employees of the mine, or, where the mines are in close proximity, the employees of a number of mines, are discussing the objects and benefits of organization.

When he thinks the time opportune, the organizer calls a meeting of those he believes interested in the movement and organizes them into a local union, sometimes secretely for fear of the opposition of the employers. They secure a charter and other supplies from the national headquarters for $15.00, and are assigned a number by which the local is to be officially known. In cases the jurisdiction of the local may extend to two or more collieries or mines, but as a rule it is confined to the employees of a single mine. Where a mining plant employs several thousand men they may be organized into a number of locals according either to nationality, or language, or place of residence in case they are scattered in near-by mining towns.

ELECTRIC MINE LOCOMOTIVES.

For the rapid and economical production of coal, probably nothing has been of greater service than the introduction of the electrical mine locomotives. The Jeffrey Mfg. Co. of Columbus, Ohio, U.S.A., who are pioneers and leaders in the manufacture of coal mining and coal handling machinery, early conceived of the desirability of using electric locomotives for coal haulage in mines.

Since their first locomotive was put into service in 1889 (and it is interesting to note that this locomotive is still in active operation) the Jeffrey Mfg. Co. have been continually developing improvements and different types to meet various conditions of mine service.

The illustrations show a number of the Jeffrey Electric Locomotives in operation. Among their more recent types are the combined rack rail and friction traction locomotives shown in figures 1 and 2. These locomotives are provided with sprockets for propelling the locomotive up steep grades. where friction traction alone would be inadequate.

A perforated steel plate of proper strength and wearing qualities forms the rack in which the sprockets run. The locomotives shown in figures 1 and 2 are arranged so that they may be propelled either by plain friction traction or by the sprockets in the rack. The economy of such a combination is self evident. It is necessary to provide the rack rail only on grades where the locomotive is unable to perform its duties through friction traction alone.

The locomotive shown in figure 2 is designed for heavy duty where it is necessary to retard or to haul trains on steep grades. Each unit is provided with two sprockets, one on either axle, so that the double unit has a total of four sprockets to act in the rack. In actual test, the locomotive shown in figure 1 has hauled a train up a 10% grade, which required an effort on the rack of 22,000 lbs. The motors were not severely taxed in this duty.

Figures 3, 4 and 5 are views of Jeffrey standard electric mine in locomotives. Figures 6, 7 and 8 show Jeffrey electric gathering locomotive in operation The feature of Jeffrey electric gathering locomotives which distinguishes them from other types of mine locomotives, lies in their ability to operate in mine rooms and on side tracks at a distance from the trolley wires. When so operating, the locomotive is arranged to take current through flexible insulated conductors. This flexible cable is wound on a drum carried by the locomotive. When it is desired to leave the main tracks, the end of the cable is connected to the trolley wire, the trolley pole is lowered and the locomotive is operated by current through the cable.

As the locomotive runs away from the trolley wire, the cable is automatically paid out and as the locomotive returns again towards the trolley wire, the cable is automatically wound up with uniform tension and in even layers. This type of locomotive which has been introduced by the Jeffrey Mfg. Co. is proving very successful and is rapidly replacing mules and horses in mines.

Many of the largest operating Companies in the United States to day are adopting electric gathering and haulage locomotives. to the entire exclusion of animal haulage.

The Jeffrey Mfg. Co. manufacture a great variety of sizes and styles of electric mine locomotives to suit the various conditions met with in mine service: they are prepared to fill order from standard patterns for locomotives weighing from 2½ to 40 tons. Their

Fig. 1.

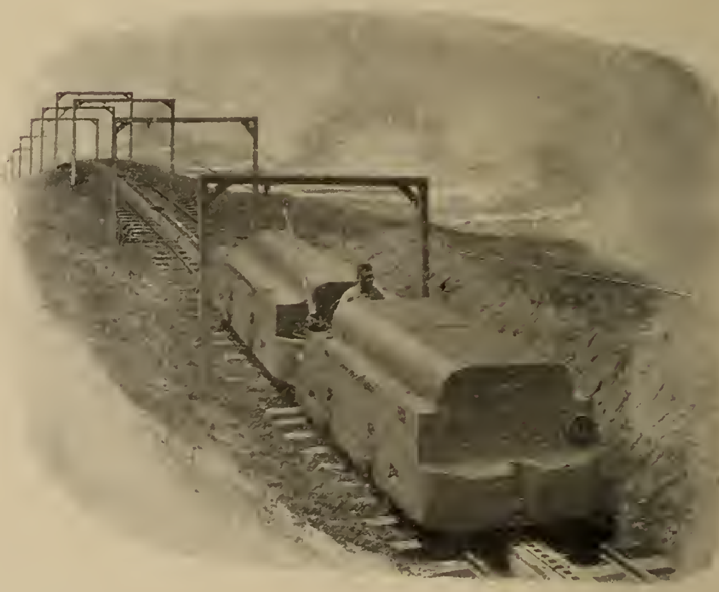


Fig 2.

Fig. 3.

Fig. 4.

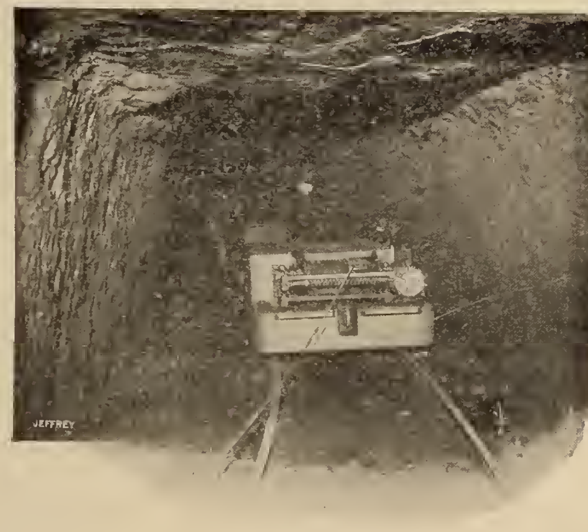


Fig. 7.

Fig. 5

Fig. 6.

experience has been so extensive that hardly any conditions can be presented which they are not able to meet, with standard apparatus.

The electrical equipment employed in Jeffrey locomotives is of a higher class than is furnished in any other form of electric traction work,

As the conditions under which mine locomotives have to operate are very severe, the Jeffrey Mfg. Co. have provided exceptional capacity and superior methods of construction and insulation, which their experience has skilled them to produce. The manufacturers of street railway apparatus do not provide such equipments, as their operating conditions are much less severe and their experience has not skilled them in the vital points necessary to successfully meet mining conditions.

[Ad.]

Fig. 8.

AMENDMENT OF YUKON LAWS.

At the forthcoming session of parliament the Governor of the Yukon, the Hon. W. W. B. McInnis, will present to Governor-in-Council the suggestions of the Commission to which was entrusted the matter of needed changes in the mining laws of the Yukon. So far as can be learned the principal new features are as follows:—

All big tracts of ground for extensive operation must be acquired by grouping ordinary claims. No more concessions are to be granted.

Miners' licenses are abolished. The size of claims, manner of staking and surveying remain as they have been for some time.

Disputes over distributions of water, boundaries, dumping ground encroachments and such like shall be referred to an arbitration board to be appointed by the gold commissioner or recorder. Judgments shall be final except on points of law. No appeal on the interpretation of the whole code is to be above the Yukon courts.

To encourage prospectors, one man may take five powers of attorney on filing record that that number of men grub-staked him. Distant prospectors can obtain the privilege of filing record six months after staking.

An owner may abandon his claim on any creek at any time by giving notice to the recorder, and locate elsewhere on the same creek. If he sells, he cannot locate on the same creek for a year.

Leases of ground may be obtained for one to five years. The fees are to be $10 for one year and $70 for five years.

Two hundred dollars' worth of work must be done annually on each claim on the valuation fixed by the gold commissioner; failure to do the assessment work means absolute forfeiture at the end of the year.

All owners in the claim shall do representative work according to the share owned. Failure means that the ground lapses to the other partners.

See page water belongs to the claim where it originated.

COAL NOTES.

NOVA SCOTIA.

From reports current at Glace Bay it is believed that the Cape Breton Coal, Iron & Railway Company have purchased the areas owned by the Cumberland Coal Company in that vicinity. This area is a very large one, approaching about 20 square miles, and if the report is confirmed the company have very much increased the resources of their Broughton property.

Under date of Feb. 28th, we are advised that the Intercolonial Railway has given a contract to the Port Hood Coal Company for deliveries of coal during the coming season. Dr. McLennan, the member for the county, has made an application to Parliament for a grant of $20,000.00 to continue the work on Port Hood harbour. It is also stated that satisfactory arrangements have been completed by which the additional capital required will be subscribed at once, and that development of the collieries will be proceeded with immediately.

The machine shops of the Dominion Coal Company have been kept busy during February in repair work on machinery in preparation for the coming season. Several of the locomotives have been overhauled and the general up-keep of the various machines is being closely attended to.

It is rumoured that the general-store business of the Dominion Coal Company will shortly be abolished. As the result of an examination into the matter of the Company's stores made by Mr. W. H. Kelson it is reported that orders which had been placed before his arrival have been countermanded or cancelled. These rumours are not confirmed by the Company, who are reticent upon the subject, but the procedure which is being followed is sufficient to justify the belief that if the business is not entirely discontinued in the future it will be very much curtailed.

The Cape Breton papers announce that the various iron ore properties in the neighborhood of Whycocomagh have been merged into one company, which has taken the name of the Canadian Iron & Steel Company. Who are behind the enterprise has not yet transpired, although the announcement is made that a very considerable sum will be at once expended in development. The result of the test pits which have recently been sunk upon the different areas has shown fairly good quantities of exceptionally high grade, magnetites, hematites and specular ores. Many samples have carried from 65 to 66 per cent. of metallic iron. The bands of ore are all favourably situated within a mile to two miles of an excellent harbour, where 24 feet of water is obtainable the year round, and which is also open for eight months of the year. Some of the deposits are also within one or two miles of a line of road which has been surveyed from Orangedale to St. Rose. The authority for these statements is the *Inverness News.*

With the beginning of this month Colliery No. 3 of the Dominion Coal Company went on double sihft; the reserve colliery is also double shifted and rumours at Glace Bay are to the effect that two other collieries will work a double shift in a short time.

The steamer "Hawkins" has been carrying coal all winter between Morien and Maine points.

The new colliery to be opened by the Nova Scotia Steel & Coal Company will be called "Sydney No. 4," and will be opened on the outcrop of the old Sydney main seam, in what is known as the Bras d'Or district. It will be about 1½ miles distant from Colliery No. 3. The slope is to be driven across the dip instead of on the full dip of the seam, and is to have a grade of about 2 to 3 per cent. The levels will be driven from the slant at about the same percentage of grade, but the rooms will be broken off from the levels practically on the plane of the coal. In this way grades will be overcome in all the workings. The haulage is to be entirely electric; an electric locomotive of about 6 tons weight will bring the coal from the rooms to the levels and an 18 ton electric locomotive will bring trains, of from 40 to 60 mine cars, to the surface where, without transfer, the cars will be taken direct to the tipples at No. 3. There are to be no bankhead engines, nor plant at the slope mouth of the colliery. Mining is to be done by a chain cutter driven by electricity and the mine will be worked on the room and pillar plan for the first three lifts, owing to the slackness of the cover, but below the third lift it will be worked on the long wall principle. The surplus gases from the blast furnace and the coke ovens will generate the power for the machines at the new colliery, and the electricity will be carried to No. 4 by way of colliery No. 3, where a portion of the power will be diverted to run ventilating and screening apparatus. The generating plant is to consist of two 500 K.W. direct connected generators, with a sub-station at No. 4 to reduce the voltage from 6600 to 220 volts.

BRITISH COLUMBIA.

The Crow's Nest Pass Coal Co. is appealing the assessment recently imposed on it of $790,000 for 64,000 acres of coal lands and also against the assessment of 163,000 acres of wild land at $1 an acre. The former will bear a tax of 1 per cent., or $79,000 per annum, while the wild land will bear a tax of 4 per cent., or $6,557.75, making in all $14,457.75.

A recent test of coal from the mines of the Crow's Nest Pass Coal Company, made by the engineers of the Northern Pacific railway, has proven highly satisfactory and has established beyond doubt the excellent qualities of Crow's Nest coal. The trial was made on a run between Livingstone and Billings, Montana, at which R. W. Coulthard, general sales agent of the coal company, was present. Statements made by Mr. Coulthard to the Fernie Free Press are to the effect that former tests had been made of western coals but that this one made of the Crow's Nest Pass coal was much superior to any others, especially in respect of its efficiency for steaming purposes.

COMPANY MEETINGS AND REPORTS.

The Crow's Nest Pass Coal Co. Annual Meeting.

The annual meeting of the Crow's Nest Pass Coal Co. was held in Toronto on February 9th, with the Hon. Geo. H. Cox, president, in the chair.

The ninth annual report of the directors showed that the net earnings of the year had amounted to $497,898.68.

The Reserve Fund has reached the figure of $1,800,000.00.

The general statement was as follows:—

General Statement, 31st December, 1905.

ASSETS.

Mines, real estate, plant, development, etc.	$5,374,644.89
Securities owned	328,296.98
Accounts receivable	616,803.27
Cash on hand and in bank	13,772.98
	$6,333,518.12

LIABILITIES.

Capital stock, paid up	$3,500,000.00
Bills payable	367,769.96
Accounts payable	226,447.09
Dividend No. 20, payable Jan. 1, 1906	87,500.00
Reserve fund	1,800,000.00
Profit and loss	351,801.07
	$6,333,518.12

PROFIT AND LOSS ACCOUNT.

For year ending 31st December, 1905.

Balance at credit, Dec. 31, '04	$203,320.44
Net profits for 1905	497,898.68
Premium received on calls paid on new stock	35,400.00
	$736,619.12

Appropriated as follows:—

Dividends paid	$349,418.05
Transferred to reserve fund	35,400.00
Balance carried forward to 1906	351,801.07
	$736,619.12

Directors elected were: Hon. G. A. Cox, Robert Jaffray, Lieutenant-Colonel Sir H. M. Pellatt, William Fernie, J. D. Chipman, E. R. Wood, David Morrice, Thomas Walmsley, Lieutenant-Colonel Mason, Frederic Nichols, G. G. S. Lindsey, K.C., C.C. Dalton and James W. Woods.

At a subsequent meeting of the directors the following officers of the company were re-elected for the ensuing year:—

President, Hon. Geo. A. Cox; 1st vice-president, Robert Jaffray; 2nd vice-president and general manager, G. G. S. Lindsey; treasurer, E. R. Wood.

The production of the company since its inception is shown in the table below:—

	Tons Coal.	Tons Coke.
1898	8,986	361
1899	116,200	29,658
1900	220,458	73,496
1901	425,457	125,085
1902	441,236	120,777
1903	661,118	167,739
1904	742,210	245,118
1905	831,249	257,702

Imperial Development Syndicate.—The Annual general meeting of the Imperial Development Syndicate was held in Nelson on the 13th of February, when the following report was submitted by Mr. A. H. Gracey, the manager of the Syndicate:—

During 1905 and up to the end of January of this year, development to the extent of 1,200 feet has been added to the previous work. During the same period, Jan. 1, 1905, to Jan. 31, 1906, 12,300 tons of ore have been mined, the largest portion of which was produced from development work.

The following summary will show the results:—Bullion produced, $45,184.66; per ton, $3.66½; concentrates, estimated, $7,150.00; per ton, 58½ cents; total bullion, $52,234.66; total value per ton, $4.25. The gross value of the ore has averaged about $5 per ton.

The cost of this work, including the development, mining, ærial tramming, milling, maintenance, management and general expenses at Camborne, not including the 2 per cent. tax, was $3.94 per ton.

The following figures, being a summary of the whole production since the mill was installed, will also be of interest:—Tons milled, 20,000; bullion produced, $94,108.27; concentrates, estimated, $8,715.00; total, $102,823.27, or an average of $5.15 per ton.

Power drill equipment and larger milling capacity are now essential to reduce costs and place the property on a proper profit earning basis. It is estimated that costs can be thus reduced to $2 or even less per ton, which would leave a nice margin or profit on the grade of our ore bodies. Large quantities of this ore exist as is thoroughly proven by the past work, and everything indicates that future work will continue to add to these reserves.

MINING INTELLIGENCE.

ONTARIO.

The Atikokan Iron Co., of Port Arthur, is installing two 75 kilowatt direct connected units, consisting of Robb-Armstrong engines and Westinghouse generators.

A rich discovery of copper ore is reported to have been made on the Soo branch of the C.P.R. in the neighborhood of Dean Lake Station.

The work of opening the Hutton Township iron properties is to be commenced shortly, and the operations will be in charge of Mr. Norman L. Leach of Duluth, who will first erect the necessary buildings and will then proceed to develop the mine.

A telegram from Dr. Eugene Haanel, Superintendent of Mines, to the Hon. Frank Oliver, Minister of the Interior, dated the 24th of February, reads as follows:—

Sault Ste. Marie, Ont.,
February 24th.

Hon. Frank Oliver, M. P., Ottawa, Ont.:

"Successful demonstration of all points stated in my memorandum on electric smelting of Canadian iron ores requiring investigation. Output greater than the figure adopted by Harbord in report of Commission. Successful smelting of magnetite and desulphurization of pig. Successful substitution of charcoal, and therefore of peat coke, for coke. Consumption of electrode, insignificant. Production of nicklepig of fine quality from roasted pyrrhotite. Forty tons of pig have so far been produced. Process admits of immediate commercial application. Experiments will be completed in about two weeks."

(Sgd.) EUGENE HAANEL,
Supt. of Mines.

The wording of this telegram leaves a considerable amount of information yet to be given, before commercial value for the process is established.

E. T. Corkill, Inspector of Mines for Ontario, is making an inspection of the mines in the Northwestern part of the province.

The Antoine mica property at Devil Lake has been sold by Mr. W. J. Webster to Messrs. J. M. Stoness of Westport and to Kent Bros. of Kingston, who are to open up the property in the coming spring.

The Minto property has recently been examined by a Mr. Reed, a mining engineer of London, who has given a very favorable report upon the property. Mr. Reed reports that the average of his samples showed from $40.00 to $50.00 per ton in gold. Mr. Reed was accompanied to the property by its manager, Mr. H. T. Thorle.

The Temiscamingue Mining Company, Limited, has been authorised to increase its capital from $100,000 to $500,000 by the issue of 400,000 shares of new stock of one dollar each. The Jubilee Mining, Limited has been authorized to make a similar increase from $500,000 to $3,000,000 by the issue of 2,500,000 shares of new stock of one dollar each.

The edition of 5000 copies of the second part of the annual report of the Bureau of Mines for Ontario, containing an account of the Cobalt ores, is exhausted and 10,000 more will have to be printed to meet the demand,

There have been rumours for some time that the Canada Chemical Company is about to erect works in Central Ontario, probably at Tweed, for the manufacture of nitric and sulphuric acid, and other chemicals, using the sulphur from ores in the vicinity, which now goes to waste. Imported sulphur has hitherto been used in Canada for making acids.

The Welch gold property on islands near Fort Frances has shown some very valuable samples of free gold ore, the assays running as high as $50. a ton. Some Winnipeg capital is interested in the porperty, which will be developed as soon as snow leaves. It is the intention to sink the shaft and to obtain the power from the electrical installation at Fort Frances.

Dispatches emanating from Ottawa report that the experiments conducted at the Soo by Dr. Heroult, in the line of smelting iron ore by electricity, have shown cost not to exceed $10.00 per ton. We regret that the officials in charge have decided to give out no information until the Canadian Government's report is published, but until this report makes its appearance, such figures as to cost will not be very seriously entertained by our iron masters.

The old Hoepfner nickel smelting plant, at Hamilton, Ontario, has been purchased by a syndicate of mine owners in Coleman Township, whose purpose it is to remodel the plant for the purpose of treating successfully the ores from the Cobalt district. The chief movers in the matter are Messrs. W.G. Trethewey, of the Trethewey Mine, and John McMartin, of the La Rose mine. It is stated that the city Council of Hamilton have given the Company a satisfactory rating for assessments, and work is to be commenced immediately.

The Bruce Mines in the Algoma District have again been re-organized and the name of the new corporation is "The Copper Mining and Smelting Co. of Ontario, Ltd." The capital is one million dollars of which sixty thousand shares are offered at par. The property including plant, buildings etc., is transferred for one hundred and twenty thousand fully paid shares of the Company.

Difficulty is being experienced by the Sudbury, Copper Cliff and Creighton Electric Railway in making suitable arrangements with the council of the town of Copper Cliff for a right of way through that town. The promoter of the road, J. R. Gordon, made application to the Railway Committee of the Ontario Government for a permissive order to operate over a portion of the public highway, and to expropriate private property. The matter came before the Committee on the 13th of February, Major Gordon being represented by Mr. J. M. Clark, K. C., the town of Copper Cliff by Mr. D. L. McCarthy, and the Canadian Copper Co. by Mr. H. E. Rose. The hearing may be taken to have been adverse to the project, inasmuch as the Committee expressed the feeling that the Co. could not be given the right to run over the highway if the town council objected. The matter is at present hanging fire.

The Northern Ontario Copper Company, Limited, a new organization with a capital of $500,000.00, has acquired tho recent discovery of copper on the Leziert property in Dean Lake. At the present time the development is limited, consisting only of a shaft 20 feet deep, which however shows a vein of 9 feet in width, carrying yellow sulphide of copper of an usually high grade. The officers of the company are chiefly from the town of Sault Ste. Marie, the president being Dr. J. H. Gimby and Uriah McFadden, secretary-treasurer. It is the intention of the corporation to sink and cross cut on the deposits, the present shaft not showing the boundaries of the vein. With successful development the company proposes to smelt its own ore, but the ore taken out during development will probably be sent to the copper smelters near Sudbury.

The paragraphs which have appeared profusely in the general press of Eastern Canada, to the effect that the Laurentian property contained a vein of solid gold three inches thick are, of course, manifestly false. A small vein of the Laurentian Mine has yielded remarkable rich samples, and hand specimens have contained fully one-half, if not more, of their weight in gold. If several tons of such ore could be collected and milled, undoubtedly they would produce at the rate of $300,000.00 to the ton, but this rich streak does not carry to such distances, either in depth or length, to justify reports which have been given out. Nevertheless, in spite of these exaggerated paragraphs, our information is to the effect that several promising discoveries and developments have been made, especially in the Manitou district, which, if carefully followed and wisely administrated, may resuscitate the present moribund condition of Ontario's gold mining industry.

BRITISH COLUMBIA.

(Special Correspondence).

The shipments of ore from the Kootenay-Yale district of British Columbia have been far beyond the average. If the lead portion of those districts keeps up the rate at which it has started it is likely that the output for this year will be from 50 to 100 per cent. larger than has ever been the case before. While this is the prospect before the Slocan and East Kootenay, Rossland is also doing fairly well and is also likely to be far in advance of the record of the past year. Boundary is going ahead even more rapidly and the total output for 1906 is already estimated as being likely to exceed 1,500,000.

A most important development has recently taken place with regard to the smelting of lead ores, especially those ore in which occur large percentages of sulphur, i.e., the invention of a new double furnace which was lately tried at the new works which are now in progress at the old Pilot Bay smelter on Kootenay lake. The principle of the furnace, of which a more detailed account will be forwarded at a later date when a new plant has been blown in definitely, is that the ore is introduced into one side of the furnace with *coal* instead of *coke*. This stack is closed at the top, and communicates with the other, which is alongside, the bottoms of both being placed over a large crucible. In the second furnace is put no fuel whatsoever; the ignited gases coming from the combustion in the first stack are declared to be sufficient to smelt the ore in the second, which is open at the top just as is any ordinary blast furnace. A detail in the construction, which is of some importance, is that the tuyeres are arranged in a double and not a single set, and are placed towards the middle of the furnace rather than close to the bottom.

The point of the matter is that the fuel used is coal not coke thereby making a saving of much importance, as the amount of coal is only from ¼ to ⅓ of the amount of coke used. An experiment has been tried in a furnace of 40 tons capacity and the ore used was Blue Bell, which contains 25 to 30 per cent. of sulphur. The ore is fed to the furnace raw, that is there is no expenditure of fuel necessary for desulphurization. This is another big saving in reduction expenses. The Blue Bell mine has long been known to contain large quantities of ore but it was of low grade and moreover was much mixed with zinc, hence the mine had little commercial value. Under the new conditions the Blue Bell is likely to become one of the most important shippers in Ainsworth camp. A furnace of 120 tons capacity is in course of erection and the necessary machinery has been ordered from Eastern Canada. It is expected that the blowing in of the plant will be attempted early in March.

At the Hall Mines and the Trail smelters there are extensive alterations in progress, running well into five figures as to cost, for the purpose of installing desulphurizations plants of the Huntington-Heberlein type. It must be understood that while some of the ores of these districts are heavily impregnated with sulphur, and therefore probably highly suitable for the new double furnace just noted, others are poor in that ingredient but yet contain sufficient to make its elimination a matter of moment in the reduction of the ore. Hence there is room for both the Huntington-Heberlein and for the new "Blanchard" furnace, as the double furnace is called from the name of its inventor.

The trouble of the Boundary, lack of power, has apparently been overcome by the entry into that country of the West Kootenay Power company which is installing a 50,000 horse power generating electric power plant at Bonnington Falls on the Kootenay river just below Nelson. The Granby will now be able to work all of its eight furnace and the B. C. Copper and Dominion Copper smelters will also be enabled to go ahead with the installation of additional furnaces. One thing that is still troubling the Boundary people is the freight charges. However, this is now in the hands of the railway officials, and, as there seems likely to be at least two competing transportation companies in the Yale district, the freight charges will probably come down in the near future.

In Rossland it is understood that the new director, Mr. Anthony J. McMillan, will arrive towards the middle of next month and that he purposes to restart the smelter at Northport. It may be noted, by those who have been reading the weekly mining reports which are issued for the whole district by the Nelson Daily News, that the shipments for the Le Roi mine are much lower than they used to be. They fall below the 2,000 ton mark, whereas the capacity of the machinery and shaft was designed for an output of 5,000 tons by Bernard Macdonald. The capacity of the mine is not less today, especially with the low rates on ore now prevailing for treatment. Whether this has or has not any significance with reference to the Trail smelter is for the onlooker to judge. Anyway there seems to be trouble in the air. The War-Eagle-Centre Star mine has greatly improved by the finding of a portion of the ore body in the lower levels in the former mine, and in the Josie and Le Roi No. 2, ore has also been found in gratifying quantities at depth. On the whole the outlook for the Rossland mines is good, despite the fact that the recent changes in the Le Roi management may breed trouble. It is possible that the recent fright that the people of Washington, especially of Northport, have experienced in the closing of the large reduction works may lead to a better frame of mind and to a cessation of the constant efforts to regard the English owned works as a sort of milch cow. It is to this that the expenses of the Northport smelter are largely to be attributed. If this, however, does not cease the present Le Roi management will have to adopt a policy of bringing their plant over the boundary line, whether they like it or not, or, in default of shipping to the Trail plant.

The mines of Rossland have been badly treated in public estimation. The total value of the ore raised since the beginning of the camp is upwards of $35,000,000, the returns to the shareholders have been inadequate. The cost of treatment has been all the way from $16 a ton downwards till today it is $3. Had the lower rate been possible, at the outset, Rossland camp would have been one of the largest dividend payers in the whole of the interior, perhaps on the continent. However, with the rate as it is, there lie huge profits before these mines if properly handled.

The total amount of the lead bounty distributed in 1905 was $334,224.00.

The record of shipments from the boundary country for the present year is at the rate of more than a million and a quarter tons per annum.

The Pathfinder mine, which is a gold-copper proposition some twelve miles from Grand Forks, has been bonded to the Granby Company for a period of 18 months, and for the sum of $110,000.00, to be paid in monthly instalments until the full payment has been completed.

During the five years ending with the 31st of December 1905 the Granby Consolidated Company mined and smelted over 2,118,930 tons of ore. This company, which was originally entirely Canadian, now has less than 50,000 of its shares owned in Canada. The total issued capital is 1,350,000 shares.

The Never Slip claim, recently located by Joseph Simpson, contains a ledge of white quartz 12 feet in width, which carries free gold, visible to the naked eye. Report says that this ledge was found by Mr. Simpson when hunting. The quartz appears to be a pie-milling one, being similar in character to the Cariboo Camp McKinney. A small stamp mill is to be supplied to the property during the coming summer.

That concentration has become quite a factor in the practice of British Columbia is shown by the fact that there are at present 15 concentrating mills in the Slocan district alone. The most of these mills were introduced with the object of making the zinc contents of the Slocan lead ores available for market. The probable cost of these 15 mills is in the neighbourhood of half a million dollars, and our esteemed contemporary, the *Sandon Mining Standard*, makes a good point in stating its belief that one good custom mill, centrally located, would better have served the interests of the whole Slocan.

The report of the B. C. Copper Company, Ltd., submitted at the annual meeting in New York last month, ended with the financial year closing Nov. 30th., and showed net profits for the year of $102,907.00; the surplus to the credit of profit and loss account was $191,828.00. In speaking to the report President Underwood said, that against the profits there had been charged large sums for extensive developments which had been made to prepare for a very such increased output. These developments had disclosed bodies of ore of higher grade than those previously worked. The machinery for the new smelting plant has been contracted for, and deliveries of the same will begin during March; complete installation is expected to be finished during the summer. The new plant is to have a capacity of 50,000 tons per month, as against the present capacity of 18,000 tons. A full electrical equipment is to be provided for both the mine and smelter. 37,500 shares of treasury stock were sold during the year, the proceeds of which have been entirely devoted to development, acquisition of new properties and plant.

NOVA SCOTIA.

The Little Bay Copper Mine in Newfoundland has a prospect of again being opened up; Mr. C. F. Taylor is at present in charge of the work.

The Mic Mac mine, in the Leipsigate Gold District near Bridgewater, N. S., has been sold to New York people who have incorporated under the title of the Mic Mac Gold Mining Company, with a capital of $1,500,000.00 divided into three hundred thousand shares of $5.00 each. The corporation is under the laws of the State of Maine.

The annual meeting of the Nova Scotia Oil & Gas Company was held in Halifax during February. The new bore hole has reached a depth of 1020 feet and is about one mile to the northwest of the old bore hole. It will be remembered that this corporation has been boring at Cheverie, C.B. in the hope of obtaining oil and gas, but had to suspend operations last November because of the approach of winter. The financial statement of the company showed a balance on hand of about $1,000,000, and the directors ask the shareholders to contribute sufficient additional funds to continue the boring of prospects holes in the spring

Advices from Nova Scotia are to the effect that the Mabou coal mine is now being vigourously developed under new management. It is contemplated to increase the shipping facilities and make the colliery a regular shipper during the present year. The quality of the coal in the 8 foot seam is very much improved.

Mr. C. Ochiltree McDonald is again to the front in Nova Scotia in connection with the North Atlantic Collieries Company, an English corporation, which is planning to open a colliery at South Head, Port Morien, Mr. McDonald is a director of this Company, and has recently been interviewed by the Sydney *Record*. The company plans are designed for an output of a million tons per annum, with shipping point at Curry's Cove in Cow Bay. The control of this corporation, it is stated, will be in the hands of Canadians, and the policy to be pursued will be one of competition with existing Cape Breton collieries. The expectations of the company are that they will be able to secure the major part of the trade with foreign markets as well as hoping to get a share of the home market.

Memo, areas taken under prospecting License during February 1906.—

DISTRICT.	NO. OF AREAS.
Montague	26
Waverly	22
Uniacke	21
Stormont	182
East River-Sheet Harbour	43
Gold River	20
Lower Selma	24
East Side, Lake Porter	18
Black River	12
Fifteen Mile Steam	10
Scraggy Lake	6
Millers Lake	39
Indian Path	8
East Rawdon	25
	456

MINING NOTES.

The Robb Engineering Company has received an order for a 150 horse power tandem compound engine for the Nipissing Mining Company, Cobalt, Ont.

The gold mines and the mill of the Royal Oak Gold Mining Co. at Goldenville, N.S., have been placed under the management of Mr. S. G. Evans, under whom it is expected that the company will resume its place as a gold producer. The January crushing amounted to 133 tons yielding $1,420.00.

Mr. Mayhew, President of the Cape Breton Coal Iron and Railway Co., with two directors, Mr. Gladstone and Mr. Noel Humphrey are in Cape Breton, for the purpose of deciding as to some matters concerned with the building of the proposed railway from Broughton to Louisburg.

On the morning of February 8th, the Quincy Copper mine, near Houghton, Mich., experienced a series of minor earthquakes caused by falls of ground producing some terrific air blasts throughout the workings. The three southerly shafts numbered two, four and seven, were blocked with fallen rock and the trucks on the skip roads were smashed to splinters. There were no fatalities reported; due, probably to the fact that the falls occurred between five and seven o'clock in the morning. For the next twenty-four hours the disturbances continued to be felt on the surface, and the miners have refused to go underground.

Copper news from Boston is bullish, and the market price of copper bears out this sentiment. The Franklin and Tecumseh, together with mines on the Kearsarge Lode, are all looking extremely well, and the Allouez still keeps up its remarkable record; almost all of the properties are making a good showing, as they might be expected to do with the remarkably high price for copper now obtaining.

Mr. Colin Campbell of Nova Scotia has expressed the opinion, warranted by a long residence and examination of the section, that from the Laurentides west of Lake Superior and northerly of the height of land will furnish a mining district equal to any of those in British Columbia.

The output of the Dominion Coal Company for the month of January from the different collieries was as follows:—

Dominion No. 1	38,211
" 2	45,167
" 3	20,319
" 4	34,319
" 5	45,661
" 6	4,033
" 7	10,180
" 8	10,440
" 9	23,276
	231,606

The total shipments were 188,439 tons.

The output of coal from the Dominion Coal Co's collieries for February, 1906, was as follows :—

Dominion No. 1	38,205
" 2	42,757
" 3	21,126
" 4	35,187
" 5	45,302
" 6	5,397
" 7	8,290
" 8	6,564
" 9	23,888
	225,716

The shipments were 168,650.

The shipments from the collieries for the Cumberland Railway & Coal Company for the month of February were 39,357 tons.

BRITISH COLUMBIA.

Rossland.—Developments in the Rossland district during February have largely increased the resources of ore, especially in the larger mines, the Centre Star, Le Roi and Le Roi No. 2. It is contemplated making such developments as will enable all of the ore coming from both the War Eagle and Centre Star mines to be hoisted through the Centre Star shaft, thus saving a good deal of handling, and 200 feet of hoisting. February also saw the first shipment of ore from the Mabel mine, the development of which is proving quite satisfactory. The output of the district for the week ending February 15th, was 1000 tons greater than for the previous week.

Lardeau.—The Sunshine, one of the most recently developed claims in the district, is close to the well known Silver Cup, and the work that has been done has shown a 14 inch vein of high grade galena, running continuously through the claim. The prospects for this property are stated to be very bright.

Nelson.—The Hunter V mine, leased by the Hall Mining and Smelting Company, is looking extremely well. The most recent report is to the effect that a large amount of $20.00 ore is now in sight, sufficient to supply all shipments during the coming summer. It is reported that some samples now show considerable free silver with a slight amount of galena.

The first trial of the new Blanchard furnace at the Pilot Bay Smelter is reported to have been very successful.

Slocan.—Local reports state that a large vein of high grade zinc ore has been found in the upper workings of the Payne mine.

The Rambler Tunnel is now in a total distance of over 3700 feet, leaving only 800 feet to be driven before the objects of the tunnel are attained. It is said that the miners are making great progress with the undertaking, and that distances achieved each week are satisfactory to the management.

Reports from the Lardeau District for last month say that activity in that region is now greater than at any time during the past three years. During these years, prospectors and claim owners have been working on their own account slowly, but efficiently enough to demonstrate that they have mineral in quantity and quality sufficient for profit.

Coast.—The Potlach Creek mine, on Howe Sound, six miles south of the Britannia mine, has been acquired by English capital. The Potlach Creek mine is a galena proposition which assays high in silver and lead, and carries some gold. The mine is within half a mile of deep water, and two veins are exposed on the face of a hill near the shore. Both viens exceed five feet in width.

The Tyee mine, Mount Sicker, Victoria Island, reports the discovery of ore in its 900 foot level. It will be remembered that the ore body was lost on the 300 foot level, and that the discouragement was severe. Sdoulh the new discovery show up as a large body the Coast mines will feel the benefit coming from the impetus thus given to the district.

East Kootenay.—The record of the St. Eugene mine for 1905 shows that 130,000 tons were milled, as against 73,000 tons in 1904; that 30,000 tons of concentrates were shipped as against 15,000 tons in 1904; that 40,000,000 pounds of lead were produced as against 21,000,000 lbs. in 1904; 1,000,000 ounces of silver as against 541,500 ounces in 1904. Of the total ore and concentrates produced only 11,708 tons were shipped to Europe, all of the balance having gone to the Nelson and Trail smelters. The average metallic contents for the year were: Silver 24 oz. and lead 67%. The net earnings of the St. Eugene for 1905 were in excess of half a million dollars.

Mr. William Fleet Robertson, Provincial Mineralogist of British Columbia, reports the finding of Corynite on the Grace Dore claim, near Fort Steele. Corynite is a compound of nickel, arsenic, antimony and sulphur.

Atlin.—The year 1905 in the Atlin istrict did not show as many men employed in mining operations as during the year 1904, nor was the total value of gold produced equal to that of the preceding year. The results, however, per capita were quite as good as in previous years. One of the draw-backs during the past season was the scarcity of water, owing to the light snowfall during the preceding winter. The operations of the dredge owned by the British American Dredging Company, Ltd., showed a very fair return from the amount of gravel handled, but difficulty was experienced in getting a sufficient amount of gravel, which was due, it is alleged, to the hard character of the gravel, or to its cemented condition. On Spruce Creek the returns were quite satisfactory, over 200 men having been employed during the season. The output is stated to have been over 8$110,000.00.

The Southern Cross mines, at Uchucklesit Harbor, have been sold to an English company promoted by Mr. H. Cecil. There has been expended upon the property something like $30,000, which has proved the great extent of the ore bodies, and smelter returns from trial shipments show that profitable gold and copper values exist.

Pay day at the St. Eugene at Moyie for last month dispersed $32,000 among the many employed around that big mine.

The Broadview mine, in the Lardeau, is now averaging about two carloads a month.

The Del Rey mine, Camborne District, reports the discovery of a new 5 ft. vein of free-milling gold quartz, branching from the old vein westerly.

A recent shipment from the Whitewater Mine assayed 233.5 ozs. of silver, 48 per cent. of lead, and 9 per cent. of zinc.

The Ymir Mill closed down on the 22nd February for two months, to enable the development work to catch up with the output requirements. For som time the stoping of the reserves has exceeded their developments.

The Consolidated Lake Superior Co. is now prospering, the yearly net earnings being in excess of $1,000,000.00. Of this amount $500,000.00 is required to pay the interest on the bond issue of $10,000,000.00. The Directors state that the Ontario Government will be relieved of its guarantee of the $2,000,000.00 loan on the first of May this year.

The Swansea mine, in East Kootenay, under bond and lease to Messrs. Claudet & Girdwood, hasstarted work. This property, though idle for several years, has had a considerable amount of development previous to the bond. It is on Windermere mountain, about five miles from the Columbia River. The bonders are satisfied of the value of the claims in Windermere district, and say that railway transportation only is required to make the district ore of great merit.

MINING MEN AND AFFAIRS.

J. F. B. Vandeleur, M. E., has gone to England to report upon certain mining properties which he has been looking into for English capitalists, who propose to invest in mines in Canada if they can find anything sufficiently promising. The parties concerned have been operating in the Rand and elsewhere.

B. J. Clergne is endeavouring to float a number of cobalt and nickel properties in the Temagami and Sudbury districts in Germany, and is said to be meeting with success.

Prof. Galbraith, of the School of Practical Science, Toronto, recently read a paper on the *Microscopic Structure of Iron and Steel* before the Engineers Club. It is to be repeated in the near future.

G. B. Kirkpatrick, Chief of Surveys in the Lands and Mines Department for Ontario, read a paper entitled *Our Northern Heritage* before the Ontario Land Surveyors at their annual meeting, in which he pointed out the very valuable character of the mineral deposits of Northern Ontario and gave great credit to prof. W. G. Miller. Provincial Geologist, for the work he is doing.

MINING INCORPORATIONS.

ONTARIO.

The Consumers Coal Company, Limited. Capital $100,000.00 in shares of $5.00 each. Head Office, Toronto. Provisional directors: Gerald Nash, Charles Birrell Elder and James Henry Hammill.

King Cobalt Mining Company. Capital $300,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Alexander McGregor, Harry Williamson Page and James Patrick McGregor.

The Jessie Fraser Copper Mining Company, Limited. Capital $250,000.00, in shares of $1.00 each. Head Office, Niagara Falls. Provisional Directors: Evan Eugene Fraser, Alexander Sutherland Murray, William Henry Ward, David Wilfrid Mitchell, James Thos. Lindsay and James Melvin Mitchell.

The Crown Mining Company, Limited. Capital $1,000,000.00, in shares of $1.00 each. Head Office: Leamington, Ont. Provisional Directors: Frederick Samuel Moss, John Henry Conover, Edward Winter, Geo. Arthur Brown, Charles Lemuel Coultis and Wm. John Clearihue.

Silver Leaf Mining Company, Limited. Capital $5,000,000,00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Clement Albert Foster, Joseph Hawley Spencer and Mary Ann Hodgson.

The Silver Star Mining Company, Ltd. Capital $40,000.00, in shares of $1.00 each. Head Office, New Liskeard, Ont. Provisional Directors: William Henry Rice, William James Evans, Fred Wellington Ferguson, William Votier Cragg and Hedley Seymour Hennessy.

Ben Allen Portland Cement Company, Limited. Capital $500,000.00, in shares of $50.00 each. Head Office, Owen Sound. Provisional Directors: Charles Payton, John McMillan, John Michael Ferguson, James Edward Day and Edward Vincent O'Sullivan.

Foster Cobalt Mining Company. Capital $1,000,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Charles Wesley Kerr, Charles Stephen MacInnes, Christopher Charles Robinson, Joseph Hawley Spencer and William Edward Watson.

BRITISH COLUMBIA.

Black MacKay Mining Company, Limited.—Capital $1,000,000.00.

Norma Mines, Limited.—$300,000.00 in shares of $1.00 each.

Similkameen Mining & Smelting Company, Ltd.—Capital $2,000,000.00, in shares of $10.00 each.

Tel-Kwa Mines, Limited.—Capital $200,000.00, in shares of 50 cents each.

Crescent Mines, Limited.—Capital $1,000,000.00, in shares of $1.00 each.

INDUSTRIAL NOTES.

Allis-Chalmers-Bullock, Limited, of Montreal, have removed their sales office for the Maritime Provinces from Halifax to New Glasgow. This is considered a more central locality for the great steel, iron and coal industries with which a large portion of their business is done.

It is officially announced that Mr. James A. Milne, who has for a number of years been comptroller of the Allis-Chalmers Company, Milwaukee, has accepted the position of general manager of Allis-Chalmers-Bullock, Limited, Montreal, Canada, to become effective on or before May 1st, 1906.

Mr. Milne is a native of Canada, having been born at Waterdown, Ontario, in 1872. He began his business career at Toronto in 1888. During the ensuing four years he was with Robert Simpson & Company, and Wyld, Grassett & Darling of that place; but in 1892 he removed to Chicago, entering the employ of Carson, Pirie, cott & Company. He then became associated with Jones, Cæsar & Company, chartered accountants of Chicago and New York, and it was this connection which brought him into touch with the Allis Chalmers Company. Since the early part of last autumn, Mr. Milne has been one of the directors of Allis-Chalmers-Bullock, Limited, and the fact that he still retains Canadian citizenship, and is deeply attached to his early associations, has been an important factor in influencing him to heed a recall to the Dominion.

The Allis-Chalmers-Bullock, Limited, Montreal, the Canadian representatives of the Allis-Chalmers Company, Milwaukee, recently received an order from the Canadian Forty-Mile Gold Dredging Company, of Toronto, Canada, for a special gold dredge equipped complete with 5½ cu. ft. buckets. The contract covers the entire machinery equipment complete, ready for operation, including electric light plant, two boilers, 100-h.p. each, engines, pumps, etc. The dredge will be ready for use early in May.

The Allis-Chalmers Company has in preparation for the account of its Mining and Crushing Machinery Department the following publication:—

The Granby Consolidated Mining ,Smelting and Power Company, Granby, B.C., one of the larger mining interests in British Columbia, has recently added another converter stand, complete with hydraulic cylinder for operating the same, to those already installed. The new equipment was purchased from the Allis-Chalmers Company, Milwaukee.

Among recent sales by Allis-Chalmers-Bullock, Limited, Montreal, were thirty of the latest improved type Coal Cutters to the Dominion Coal Co., Glace Bay, C.B.; two compound steam-driven air compressors to the Acadia Coal Company, Stellarton, N.S., and a 425-kw alternating current generator for the Corporation of Parry Sound.

The Westinghouse Machine Company have opened a Philadelphia sales office in Room 1003 North American Building. The establishment of this office was necessitated by their rapidly expanding business in this territory, particularly in gas engines and Westinghouse-Parsons steam turbines, and is in line with the progressive policy of the company to establish headquarters in all large industrial cities.

We are in receipt of Bulletin 1400 upon "Gold Dredges" from the mining and crushing department of the Allis-Chalmers Co., Milwaukee, represented in Canada by Allis-Chalmers-Bullock, Limited, Montreal. Gold dredging is a comparatively new method of recovering the precious metal and one which has proved extremely profitable where it has been undertaken under proper direction, and with dredges skilfully designed, well built and adapted to the work. This present bulletin illustrates a double lift long sluice dredge built for the Bonanza Basin Gold Dredging Co., on the Klondyke, and gives an interesting description of the operation and of the working parts.

The Westinghouse Machine Company filed a bill of complaint on February 9th, in the Circuit Court of the United States for the District of New Jersey, against the Allis-Chalmers Company, alleging that the Allis-Chalmers Company in the manufacture and sale of its turbine, is infringing Patent No. 655,414, issued to Mr. Chas. A. Parsons, August 7th, 1900. This invention was made jointly by Parsons, Stoney and Fullagar, and is for Steam Turbine Ring of Blades covering the method of construction used by the Allis-Chalmers Company for securing the blades and vanes in place in their respective holding elements. An assignment of the entire rights under this patent was secured by the Machine Company from Chas, A. Parsons on January 10th, 1905, both Stoney and Fullagar having assigned their interest in the same to Parsons prior to the assignment of the patent.

REPORT ON PATENTS—CANADIAN.

809,322—Apparatus for the Complete combustion of Solid Fuel. Adam Pfeifer, Frankfort-on-the-Main, Germany.
In a furnace in combination, a grate, a main flue, in the rear of said grate, combustion-spaces besides said main flue, air-inlets for said combustion spaces, and air-inlets behind said grate into said main flue, said combustion-spaces having apertures communicating with said main flue.

809,295—Gas Producer. Jerome R. George, Worcester, Mass., assignor to Morgan Construction Company, Worcester, Mass., a Corporation of Massachusetts.
The combination with the heating-chamber having an opening at its top for the admission of fuel, of a fuel-reservoir placed above said opening and having an opening in its bottom for the delivery to a distributer, a distributer between the opening in the heating chamber and the opening in the reservoir, said distributer consisting of a rotating shell smaller at its lower than at its upper end, with an opening at its upper end larger than the deliver-opening of said reservoir and concentric with its axis of rotation, and with an opening at its lower end eccentric with its axis of rotation, and a disk inclosed in said distributer having its diameter larger than the diameter of the delivery-opening in said reservoir, with an annular space around said disk for the passage of fuel.

809,765—Ore Concentrator. George M. Whitney, Lawson, Colo. An ore-concentrator, comprising a bed for the ore to be separated, tubes therethrough for the discharge of the mineral portion of the material, other tubes having movable relation with said first-named tubes for regulating such discharge, a supporting member for the second-mentioned tubes, and a vertically-swinging member connected with the said supporting-member.

809,522—Dump Car. Thomas R. McKnight, Aurora, Ill., assignor to Western Wheeled Scraper Company, Aurora, Ill., a Corporation of Illinois.
A dump-car, consisting of a wheeled truck, a tilting car-body having an open end, an edgewise movable gate therefor, a rotary support on which said car-body rests, and means rotating with the car-body for automatically holding up the end gate when the car-body is tilted to dump the load.

810,249—Method of Refining Copper. Ralph Baggaley, Pittsburg, Pa., Charles M. Allen, Lolo, Mont., and Edward W. Lindquist, Chicago, Ill., said Allen and Lindquist assignors to said Baggaley.
A method which consists in injecting into a bath of molten copper, granulated or comminuted hydro-carbon-gas-producing material, non-abrasive and of such nature that it will not melt and clog in the twyers at the temperatures there present.

809,939—Apparatus for Recovering Precious Metals. Edward J. Garvin, Portland, Oreg., assignor to Garvin Cyanide Extraction Company, a Corporation of Oregon.
The combination with a main tank for receiving the pulverized ore and solvent, of a separating-tank including means for separating the material, attached to the main tank near its top, and an amalgamating-tank including means for amalgamating the material suspended above the main tank, and means for causing a continuous circulation of the materials and solution through said tanks.

809,998—Manufacture of Artificial Fuel. August Stillesen, New York, N.Y.
A process of producing solid petroleum for fuel which consists in mingling, approximately, seventy-five parts by weight of petroleum, sixteen parts by weight of turpentine, two parts by weight of sodium palmitate or sodium sterate, then adding five parts by weight of caustic soda and two parts by weight of water and heating and agitating, in the manner explained.

810,301—Apparatus for Storing and Conveying Liquid Metals. Casimir von Philp, Bethlehem, Pa., assignor to Bethlehem Steel Company, South Bethlehem, Pa., a Corporation of Pennsylvania.
An apparatus for storing and transporting molten metal consisting of a vessel and suitable trucks supporting the same, the vessel having an enlarged body portion and hollow contracted cylindrical ends containing burning-chambers and means for admitting fuel thereto, said ends turning in bearings on the trucks.

810,063—Duplex Smelting Furnace. Robert Lindermann, Osnabruck, Germany.
In a duplex smelting-furnace, a primary hearth capable of being intensely heated, an inner refractory wall around said hearth, an outer metal casing surrounding said inner wall, air-passages in said outer casing, an air-inlet communicating with the said air-passages and with a source of air under pressure, a baffle-plate for directing the admission of the air in opposite directions from the said air-passages round the furnace to the said hearth, air-holes at the base of the primary hearth for admitting the air under pressure thereto, a movable plate adapted to shut off hermetically the ash-pit from the primary hearth, and a secondary hearth alongside the primary hearth and capable of being heated by the waste heat from the primary hearth.

810,605—Conveyer. Clarence K. Baldwin and Thomas Robbins, Jr., New York, N.Y., assignors to The Robins Conveying Belt Co., a Corporation of New Jersey.
The combination with a support, of a conveyer and conveyer-frame mounted to travel thereon, and having the delivery end of the conveyer both vertically and horizontally movable, and an engine or motor for operating the conveyer mounted upon the conveyer-frame.

811,040—Sintering Comminuted Ore or Flue-Dust. George L. Davison, Chicago, Ill., assignor to American Sintering Company, Chicago, Ill., a Corporation of Illinois.
A process which consists in mixing the ore or flue-dust with a small percentage of comminuted fluor, then passing the mixture gradually through a furnace and heating it until the mixture fuses sufficiently to cohere, and agglomerating the mixture into lumps by agitation while this in partially-fused condition.

810,513—Miner's Drill. Henry Todd, Marshfield, Ohio.
The combination of a supporting-frame or upright composed of pivoted selections adapted for approximately vertical alinement or angular adjustment, points for the sections, and a brace connecting the sections and adjustable to hold the same vertically aline or arranged at an angle to each other.

810,771—Dust Collector. Bernard Kern, Jr., Toledo, Ohio.
In a dust-collector, an open reel or drum having its periphery formed with equidistant bars or slats, an open-meshed fabric secure circumferentially of the reel or drum and having a fold loosely disposed between each pair of bars or slats, a separate radially-movable member loosely engaging the inner extremity of each of said folds, a spring associated with each of said members for normally retaining the engaged fold taut, and a cam member fixed to the axis of the reel or drum for coacting with and imparting an outward radial movement to each of said fold-negaging members at a fixed point in its travel to cause the tension on the fold to be lessened and suddenly renewed for the purpose described.

810,619—Steam-Boiler Superheater. Francis J. Cole, New York, N.Y., assignor to American Locomotive Company, New York, N.Y., a Corporation of New York.
The combination with a tubular steam-boiler, of superheating tubes outer superheater-pipes projecting thereinto and having their rear ends closed, inner circulating-pipes open at both ends and located within the outer superheater-pipes, an insertible and removable header, partitioned vertically into two chambers, communicating, respectively, with the outer superheater-pipes and the inner circulating-pipes, of a vertical row, a steam-supply connection opening into the header-chamber of the outer pipes, and a steam-delivery connection leading out of the header-chamber of the inner pipes.

811,085—Process of Recovering Values from Sulfid Ores. Edwin C. Pohle, Reno, Nev.
A process which consists in mixing the ore with a chlorid, subjecting the mixture to heat in an oxidizing atmosphere, cooling the product, leaching the mass with water, to remove the contained bodies soluble therein, leaching the residue with a solution of a cyanid of an alkali metal, and finally, precipitating the gold and silver from the solution.

811,239—Manufacture of Nickel-Copper Alloys. Ambrose Monell, New York, N.Y.
The method of making an alloy of nickel and copper which consists in smelting ore containing sulfids of said metals, bessemerizing the resulting matte, calcining the bessemerized product to bring the metals into the form of oxids, then reducing the oxids and producing directly a malleable nickel-copper alloy without separating these metals from each other.

811,196—Cylinder for Treating Heated Metal. George H. Benjamin, New York, N.Y., assignor to The Coe Brass Manufacturing Company, a Corporation of Connecticut.
A container for treating heated metal under pressure, comprising a cylinder, a winding of asbestos-covered wire upon the cylinder, the said wire being distributed as spaced coils, and an enclosing jacket.

811,192—Separator. Freeman R. Willson, Jr., Columbus, Ohio., assignor to Joseph A. Jeffrey, Columbus, Ohio.
In a screening mechanism for ore to similar materials, the combination of the series of inclined superposed screens, the longitudinally-reciprocating actuating revices pivotally connected to and arranged to support each screen of said series near its centre the ends of each screen being free to vibrate about the axis of the screen's pivotal connection with said reciprocating device independent of the vibration of the ends of any other screen of the series, and the series of vibrating sustaining devices, each pivotally connected to the central part of one of said screens and also connected to a relatively stationary support.

811,079—Stamp Actuating Mechanism for Ore-Crushers. Walter S. McKinney, Chicago, Ill.
The combination of a driving-gear, a cam-shaft, a cam upon said shaft, driving connections between the driving-gear and cam-shaft, and supports adjustably supporting said cam-shaft to move bodily in an arc concentric with the axis of the driving-gear.

DOMINION OF CANADA

SYNOPSIS OF CANADIAN NORTH-WEST MINING REGULATIONS.

COAL—Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of 10 cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ—A free miner's certificate is granted upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner having discovered mineral in place, may locate a claim 1,500 feet x 1,500 feet.

The fee for recording a claim is $5.

At least $100 must be expended on the claim each year, or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey, made, and upon complying with other requirements, purchase the land at $1 an acre.

The patent provides for the payment of a royalty of 2½ per cent. on the sales.

Placer mining claims generally are 100 feet square ; entry fee $5, renewable yearly.

A free miner may obtain two leases to dredge for gold of five miles each for a term of twenty years, renewable at the discretion of the Minister of the Interior.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles. Rental $10 per annum for each mile of river leased. Royalty at the rate of 2½ per cent. collected on the output after it exceeds $10,000

W. W. CORY,

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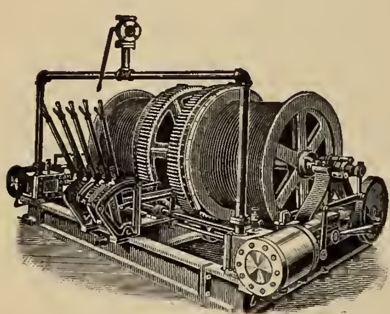

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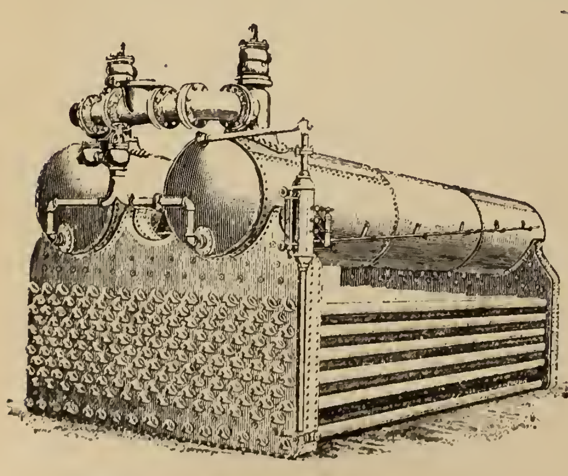

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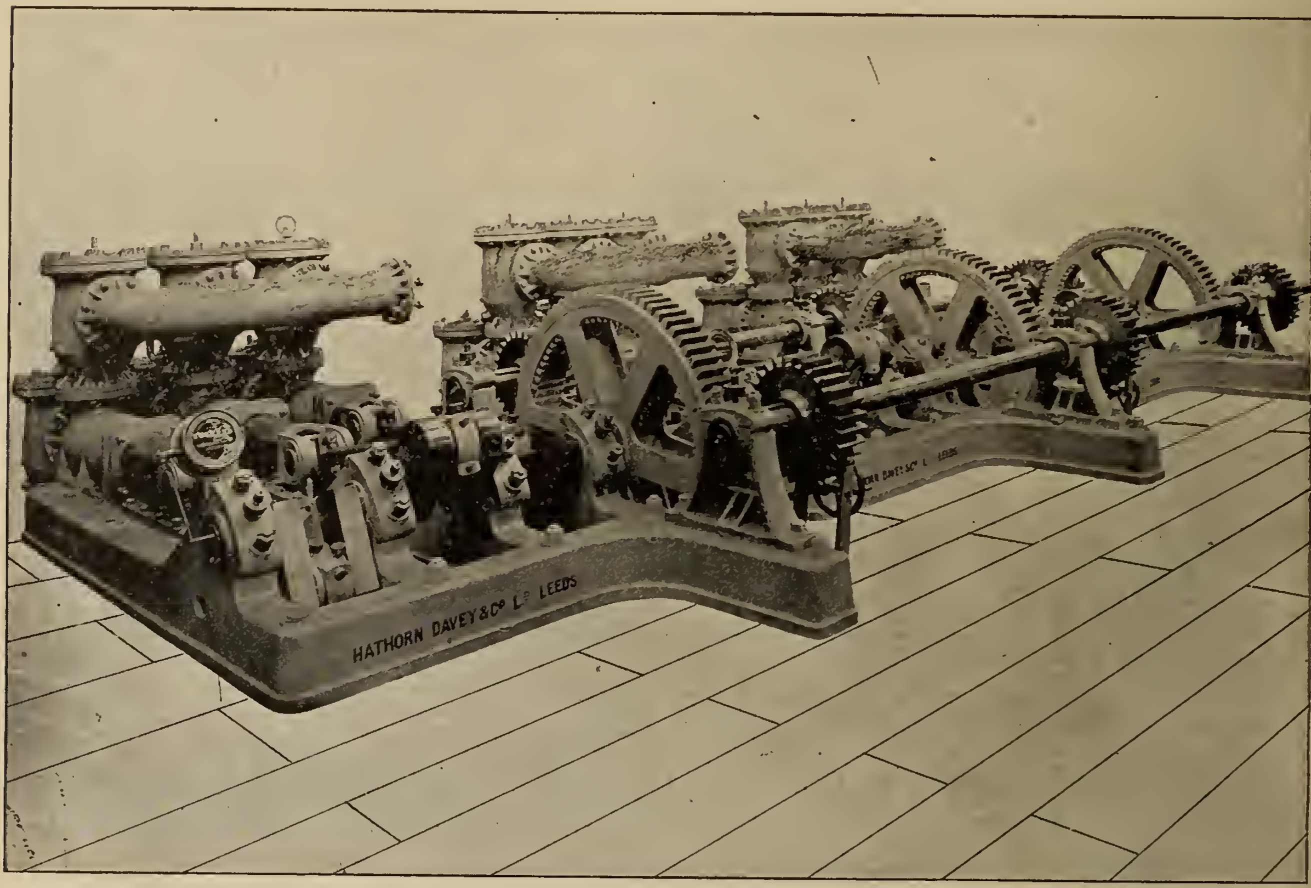
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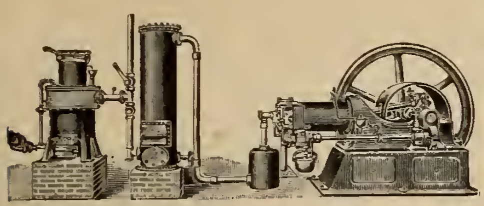

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Established 1882

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Advertising copy must reach the REVIEW OFFICE *not later than the 25th of the month* preceding publication to secure insertion in next issue.

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CONTENTS.

INTRODUCTORY NOTE.

The readers of the Review will be pleased to learn that Mr. H. Mortimer-Lamb, Secretary of the Canadian Mining Institute and Editor of the Review, is making steady, if not rapid, progress towards recovery. It is expected that he will soon be able to resume his duties.

THE NEW DIRECTOR OF THE GEOLOGICAL SURVEY.

The directorship of the Geological Survey of Canada, which has been vacant since the death of Dr. Dawson, five years ago, has just been filled by the promotion of Mr. A. P. Low, B.A.Sc., F.R.G.S. Mr. Low is a native of Montreal and was educated at the Montreal High School and McGill University. From the latter institution he received the degree of Bachelor of Applied Science in the year 1882, graduating with first rank honours. He was appointed to the staff of the Canadian Geological Survey in 1882, and was promoted

Mr. A. P. Low, B.A.Sc., F.R.G.S.

to the rank of geologist in 1891. After making several surveys in eastern and northern Quebec, Mr. Low was engaged for more than six years in exploring the Labrador Peninsula, on the resources of which he is the recognized authority. In 1896 he received the McGill Memorial Prize from the Royal Geographical Society, in acknowledgment of the far reaching value of his services. In 1897 he accompanied the "Diana" scientific expedition to Hudson's Bay, and in 1903 and 1904 commanded the "Neptune" on a similar expedition to Baffin's Land, and other parts of the far North. He is a Fellow of the Geological Society of America, and of the Royal Geographical Society of England, and a member of many other learned societies. Mr. Low, in addition to his high attainments as a geologist, is marked by a strong sense of the practical utility of his profession, and he is quite *au fait* with mining interests of the day. His splendid personality, as well as the qualifications already mentioned augurs well for his directorship. The REVIEW extends its congratulations both to Mr. Low upon the important position to which he has attained, and to his Department on the appointment of so able a head.

MINERAL PRODUCTION.

The statistics of the Mineral Production of Canada for 1905, compiled by Mr. E. D. Ingall, with the assistance of Mr. J. McLeish, which forms a part of the Summary Report of the Geological Survey, has just appeared in separate form. Increased production is the dominant feature of this valuable report. The total mineral production for the year amounts to $68,574,707, against $60,343,165 for the year previous. This is an increase of about 14 per cent. The increase too applies to all products except petroleum, natural cement, and gold from the Yukon. In the last named case there has been a falling off in the output of placer gold amounting to more than $2,000,000. This decline is attributable to lack of mining facilities for working at depths and not to exhaustion of the ore deposits.

The following are the percentage ratios of the principal minerals:—

Coal	25.77%
Gold	21.14%
Nickel	11.02%
Copper	10.83%
Asbestos	2.19%
Petroleum	1.24%
Brick, Stone and Lime	8.62%
Silver	5.26%
Lead	3.84%
Cement	2.81%
Pig Iron from Canadian Ores	1.53%

All the coal mining districts show an increase, the aggregate of the whole being about $1,000,000.00, or 6 per cent. Approximately 60 per cent. of the coal mined in Canada comes from Nova Scotia, 20 per cent. from British Columbia, 20 per cent. from Alberta, Saskatchewan and the Yukon Territory. It has the largest output, according to value, of any single mineral mined in Canada, and added to the metals, makes up 80 per cent. of the total production.

The output of silver has increased $1,558,862, or more than 50 per cent. over the previous year. This is due to the large development of silver mining at Cobalt, and to the splendid results that have been obtained. The extraordinary richness of the ore, and the comparatively small amount of development necessary, as well as the low cost of mining, are important features of this unique mining camp. "Carloads of ore, reported at from $60,000.00 to $100,000.00 in value, have not been unusual."

The newly discovered deposits at Windy Arm, Lake Tagish, on the boundary between British Columbia and the Yukon Territory, give promise of a further increase in the supply of silver during the present year.

The copper production of Canada has increased during the past year by more than four and a half million pounds. This with the increased price of that metal, has given an increase in value of more than two million dollars. The copper production has increased in each of the provinces in which copper mining is carried on, namely, British Columbia, Ontario and Quebec. The output of the mines of the Boundary District alone is estimated to have increased by one million of dollars during the past year.

The total amount of pig iron manufactured in Canada during 1905 was 527,932 tons, valued at $6,492,972.00, as compared with 303,454 tons, valued at $3,582,001.00 in 1904. Of this amount less than one sixth is yet made from Canadian ores. However, 116,779 tons of iron ore was exported from Canada during the year. The Government bounty paid for pig manufactured from Canadian ores in 1905 amounted to $1,900,206.00.

Aided by bounties to the amount of $334,224.00 the output of lead increased during 1905 by nearly 50 per cent. or more than a million dollars. Over 90 per cent. of this output has been exported to foreign countries. The lead refinery, established two years ago at Trail, and the Corroding Works recently begun by the Carter White Lead Company at Montreal, will however eventually lead to the manufacturing in Canada of nearly three-fourths of the amount at present produced.

The nickel production of the year amounted to 18,876,315 pounds, valued at $7,550,526.00, as compared with 10,547,883 pounds, value $4,219,153.00, in 1904. Some of the ores from the Cobalt district contained nickel varying in amount from 4 per cent. to 7 per cent., but these have not yet been smelted and hence are not included in this output.

Concerning zinc, Mr. Ingall writes: "The zinc ores of British Columbia, which were formerly regarded as merely detrimental constituents of the combined lead and zinc sulphuret ores of the province, have for some time been the subject of great interest on account of the demand which has recently arisen for ores of this metal. Already attention has been turned toward utilizing the zinc blende associated with the argentiferous galena of the various camps in East and West Kootenay. Mill practice has been altered at some of the mines already operating so as to give a satisfactory separate zinc product, and attention is also being turned toward the opening up of various claims where the large proportion of blende present has formerly debarred profitable work. The *Daily News*, of Nelson, B.C., estimates a production for the province of over 13,000 tons with an average content of 42 per cent. of this metal.

The recently erected smelter at Frank in Southern Alberta, owned by the Canadian Metal Company, will insure the utilization of much of the ore in the country. The production of zinc ores in this province is likely to increase very largely in the future should the active demand continue, as their existence in quantity is already known at very many places.

The whole question of supply and utilization of those ores is now under investigation by a commission instituted by the Federal Government.

The asbestos industry shows a substantial advance over the output of previous years. The production is classified as follows:—

	Tons.	$
Crude	3,768	472,859
Mill stock	46,902	1,013,500
Total asbestos	50,670	1,486,359
Asbestic	17,594	16,900
Total products	68,264	1,503,259

Exports of asbestus according to Customs returns were 47,031 tons, valued at $1,386,115.

A further increase in the production of asbestos is to be looked for when the recently discovered deposits in the Lake Chibogamoo district shall have been utilized

The natural rock cement production has declined markedly during the past year, while that of Portland cement has greatly increased. There is now manufactured about 1,346,548 barrels, but 718,275 barrels are yet imported. The present value in Portland cement is about $1.30 per barrel. There are nine factories operating in Ontario, two in Quebec, one in Nova Scotia, and one in British Columbia. The list of exports, appended to this report, indicate that there are exported from Canada, in the raw state, over five million dollars worth of copper, $1,386,115.00 worth of asbestos and $2,777,218.00 worth of silver in the ore.

THE ANNUAL MEETING OF THE CANADIAN MINING INSTITUTE.

The eighth annual meeting of the Canadian Mining Institute was held in the rooms of the Chateau Frontenac on March 7th., 8th., and 9th., 1906. Deep regret was felt at the absence, through illness, of the Secretary, Mr. H. Mortimer-Lamb, whose inability to attend the meeting was much deplored.

At the opening session, Wednesday, March 7th, at 10.30 a.m., the annual report of the Council was read, together with the financial statement for the year. A discussion arose over the comparative statement of the expenditures of the two previous years, which the Treasurer submitted as usual, in connection with his annual report. After discussion by Mr. Coste, Mr. Brown, and one or two other members, it was decided to submit the comparative statement also to the auditors before inserting it in the annual report.

The removal of the headquarters of the Institute to the rooms rented from the Canadian Society of Civil Engineers, was discussed by Mr. Smith, Dr. Barlow, Mr. Hopper and Dr. Porter, and it was explained that the new quarters were more commodious and better situated than those formerly occupied, and that they also gave the Institute the use of the lecture hall and library of the Canadian Society of Civil Engineers. The President then delivered his annual address: Members of the Institute from other provinces were gracefully welcomed to the ancient capital; the historic associations centering around the City of Quebec, the noble work of the heroic pioneers of New France, and the history of the early geological research in the district of Quebec, and the early development of mining, especially in the district of the St. Maurice, were vividly recalled; the industrial mining developments of the Province, and the promise of a brilliant future were eloquently portrayed. The President's address provoked much enthusiasm.

A vote of thanks was unanimously passed by the Institute to Dr. Porter for his services gratuitously given in taking up the work of Secretary for a few weeks previous to the meeting, which was rendered necessary by the regrettable illness of its able secretary, Mr. H. Mortimer-Lamb.

The following gentlemen were appointed scrutineers: Messrs. A. P. Low, Chairman, F. Hobart, and J. J. Penhale, and special instructions were issued to the scrutineers regarding the qualification of voters and the recognition of ballots.

The second session met on Wednesday at 3 p.m., the president, Mr. Smith, in the chair. The first paper to be presented was that by Mr. Ingall on the subject of "The Mineral Production of Canada". This paper, owing to its wide interest and importance, has been reviewed at length elsewhere in this issue. Following Mr. Ingall's paper, on the invitation of the president, Mr. W. G. Miller, Provincial Geologist for Ontario, added a few details regarding the mineral production of that province. The total mineral production of Ontario for the past year, had attained a value of $23,500,000.00, which is much in excess of any previous year. The nickel production—9,503 tons—was larger than it has ever been before. There was also an increase of 4,525 tons in copper, while the silver from Cobalt, a new production, exceeded two and a half million ounces in round numbers. The production of steel was also greater than in any previous year.

Mr. J. B. Tyrrell, Dawson City, reported for the Yukon. The placer gold deposits of that district are by no means exhausted, but certain conditions, especially of transportation and water supply, must be made easier before they can be worked to the fullest advantage. Mr. Coste added some remarks pertaining to the discussion, dealing chiefly with the question of the utilization of the iron ores of foreign and domestic supply, after which Mr. J. Obalski, I. M., Director or the Department of Mines for the Province of Quebec, made some remarks on the mineral statistics of the province of Quebec for the year.

The third paper of the session was "The Ore Deposits and Geology of the Sudbury District," by Mr. Hixon, Mr. Hixon emphasized the importance of a knowledge of the geological structure to the economical development of the mines. In the discussion which followed, part was taken by Messrs. Dickson, Barlow and Coste. This was followed by a paper by Dr. C. W. Dickson, Kingston School of Mining, on "The Genetic Relation of Nickel-Copper Ores." This was discussed by Messrs. Hixon, Hopper, Barlow, Walker, Adams and Coste, and in reply by Dr. Dickson.

Mr. Obalski then presented a paper on the "Rare Earths in Pegmatite Veins". It was noted that within the mica-bearing pegmatite veins of the Province of Quebec, several rare minerals have been found, Uranite, Monazite, Uraninite from the Villeneuve Mine, Samarskite and Fergusonite from the Maisonneuve, with Clevite from the Pied des Monts, and Orthite and Allanite from Lake St. John. Several of these are important as containing radium or as indications of tin. The meeting then adjourned.

At the evening meeting Dr. Adams occupied the chair, owing to the President's absence on Legislative duties. Mr. J. E. Hardman, M. E., then delivered an illustrated address on "The Chibogamoo Mining District", in which the history of the important developments which have recently taken place in that district was interestingly sketched. Mr. Low then presented a summary of the Geological Report, which is reviewed on another page of this journal. Mr. Obalski paid high tribute to Mr. Low's services to mining interests in the Chibogamoo district, after which he presented a paper entitled "Probabilité de Trouver des Mines au Nord de la Province de Québec". Reference was made to the probability of large mineral development throughout the Huronian belt in the Northern part of the province of Quebec, from Chibogamoo to Lake Temiskaming. Following this paper Mr. Obalski read a paper by Monsieur Armand Moscovici, "Notes sur un Dépot de Pyrrhotine Nickelifère sur une Pointe appelée "Malachite Pointe." The resemblance of nickeliferous sulphides found on the shore of lake Chibogamoo to similar ores at Sudbury, was pointed out. One analysis of these by Mr. Hersey yielded 12.03% copper. 39% nickel, with traces of cobalt.

Following this paper there was a discussion, of the preceding papers, in which Messrs. Hardman, Dickson, and Low took part, and remarks were added by the chairman.

An important paper by Mr. Lamb, on "The Advisability of the Establishment of a Federal Department of Mines," was then presented by the chairman, and one by Mr. J. B. Tyrrell, on the same subject.

In the discussion which followed these papers, part was taken by Major Leckie, Mr. Ingall, Mr. Hardman, Mr. Miller, and Mr. Low, as well as the chairman. On motion of Major Leckie, seconded by Mr. Tyrrell, the President of the Institute was requested to appoint a committee to urge upon the Government the desirability of establishing a Department of Mines, and certain other measures relative to the mining interests of Canada.

The fourth session of the Institute opened on March 8th., at 10 a.m., the president in the chair. The comparative statement of the Treasurer, since audited was read, and the report was then adopted.

The advisability of having the discussions of papers promptly reported, that is, within at most, one day's time, was suggested by Professor Walker. Dr. Porter replying for the secretary said it could easily be done by spending more money on reporting, and if the meeting desired it he would bring it to the attention of Mr. Lamb, before next meeting. The proposal was favorably received. A discussion of the desirability of the unification of mining laws was introduced by Dr. Porter. The question was referred to the committee to be appointed to wait upon the Government, as already mentioned. In the discussion of this subject Mr. Miller, Major Leckie, Dr. Porter and the President took part.

Mr. D. B. Dowling, B. A., Sc., Geological Survey Department, then presented a paper entitled "Notes on the Utilization of Poorer Grades of Coal Slack", in which methods of utilizing to the best advantage the lignites and poor coal of the West, were discussed. Further discussion on the subject of this interesting paper was carried on by Messrs. Leckie, Porter, Ingall and Smith.

Through the President, the Hon. Mr. Brodeur, Minister of Marine and Fisheries, extended an invitation to the Institute to an excursion upon the St. Lawrence, in the icebreaking steamer "Montcalm." A trip was made as far down the river as Montmorenci, and thence up to Cap Rouge. The local committee provided luncheon on board, and a most enjoyable afternoon was thus spent, the party being happily augmented by a number of ladies and gentlemen from Quebec.

The annual dinner was held in the banqueting room of the Chateau Frontenac, and about sixty members were present. The guests were: His Honour, Sir Louis Jette, K.C.M.G., The Lieutenant Governor of Quebec; The Hon. Mr. Jean Prevost, the Provincial Minister of Mines; Mr. George Garneau, Mayor of Quebec; Dr. James Douglas, of New York; Past President of the American Institute of Mining Engineers; Major Shepherd and Mr. White. A number of other gentlemen were invited, but were unable to be present.

The toasts were: The King, proposed by the Chair; the President of the United States, proposed by the Chair; the Lieutenant Governor, proposed by the Chair and replied to by Sir Louis Jette; the Department of Mines of the Province of Quebec, proposed by the Chair and replied to by the Hon. Mr. Prevost; the City of Quebec, proposed by the Chair and replied to by the Mayor, Mr. Garneau; the Mineral Industry, proposed by Dr. Adams and replied to by Mr. Hobart and Mr. Hixon; Our Guests, proposed by Dr. Porter and replied to by Dr. Douglas; the President, proposed by Mr. Hardman and replied to by Mr. Smith.

The menu was as follows, the cards being of asbestos paper in recognition of the importance of that industry in the Province:—

MENU.

Hors D'œuvre.
Malpecque Oysters.

Clear Green Turtle au Madore.

Fillet of Sole a la Marguery.

Boudins de Votaille a la Perigore.
Broiled Fresh Mushrooms on Toast.

Larded Tenderloin of Beef Boquetere.
Spinach aux Fleurons—Petits Pois an Beurre
Potato Croquettes.

Asparagus, Sauce Mousseline.

English Snipe on Corbeille.
Water Cress.

Punch au Champagne.

Salade Panachee.

Pudding Glacee Nesselrode.
Petits fours assortis—Desert Café Noir.

Sherry—Hock—Claret—Champagne.

In addition to the formal toasts there were a number of songs and recitations, and the dinner was most successful in every respect, and was pronounced by all who attended to be one of the most enjoyable ever held by the Institute.

The morning session opened on March 9th, at 11 a.m., President Smith in the chair. A paper by Dr. F. D. Adams, on "The Need of a Topographical Survey of the

Dominion of Canada, particularly with reference to the development of the economic resources of the Dominion," was presented, in the absence of the author by Mr. James White, Geographer of the Department of the Interior. The paper was discussed at considerable length by Messrs. White, Barlow and Ingall.

Mr. J. W. Evans then presented a paper on "Some Laboratory Experiments in the Electric Smelting of the Titaniferous Iron Ores of Hastings County," which was very fully discussed, Messrs. Obalski, Smith, Leckie, Hixon, Coste, Porter, Hay and Groves taking part.

The desirability of having abstracts of papers only presented, and thus of gaining extra time for discussion, was introduced by Major Leckie. Dr. Porter pointed out that this matter was connected with the printing of papers, which lay with the members, who often fail to realize the necessity of sending their papers to the secretary's office sufficiently in advance to admit of their publication before the meeting. At this stage of the programme, Mr. L. Heber Cole was presented with the President's gold medal, which was given for the best paper presented in the Student's Competition of last year, a paper entitled "Mine Surveying in the Centre Star Mine in Rossland." In making the presentation the president expressed the hope that it would be an incentive to all Dr. Porter's students to give student papers, which are always much appreciated. Dr. Porter was also called upon, and speaking for the three great Canadian mining schools, emphasized the value of the prizes to the students of mining, and of the healthy interest which they evoked amongst the students.

A resolution was then passed that, in the opinion of the Institute, the Dominion Government should enact legislation providing for the payment of a bounty of $3.00 per ton on pig iron, the product of ores raised or mined in Canada or Newfoundland, the act to remain in force for five years from the date of passage, and that a copy of this resolution be forwarded to the Premier, Sir Wilfrid Laurier, and to the Hon. W. S. Fielding, Minister of Finance.

Also, that in the opinion of this Institute bituminous coal should be admitted into Central Canada free of duty, and used exclusively for the manufacture of coke, for use in blast furnaces producing pig iron, and that a copy of this resolution be forwarded to the Premier, Sir Wilfrid Laurier, and to the Hon. W. S. Fielding, Minister of Finance.

Two papers were then presented—one, on the question of "The Education of Mining Engineers," by Dr. Porter, and one on "Laboratory Methods in McGill University by Dr. Stansfield." An interesting discussion followed these papers, in which a leading part was taken by Dr. James Douglas, of New York. Dr. Douglas emphasized the importance of the student giving more attention than is usual to the intellectual and literary side of his life. With regard to the extent of a purely technical education, he endorsed the view of Dr. Porter, that students should be taught the fundamental principles, and the use of instruments of precision. He considered the best general man to be one of very wide technical knowledge, not necessarily of too precise technical knowledge with regard to any one subject.

Important part in the discussion was also taken by Messrs. Hixon, Daru, Ingall, and some further remarks were made by Dr. Porter.

The closing session opened at 2.30 p.m., the President in the chair. A report of the scrutineers was submitted, the officers elected for the ensuing year being as follows:—

President.

Mr. Geo. R. Smith, Thetford Mines, Que.

Vice-Presidents—For One Year.

Dr. F. D. Adams, Montreal.
Major R. G. Leckie, Temagami P.O., Ont.

For Two Years.

Frederick Keffer, Greenwood, B.C.
G. Herrick Duggan, Sydney, C.B.

Treasurer.

J. Stevenson Brown, Montreal.

Secretary.

H. Mortimer-Lamb, Montreal.

Councillors.—For One Year.

Mr. John Blue	Mr. J. C. Gwillim
Mr. C. J. Coll	Mr. Jas. McEvoy
Mr. Thos. Cantley	Mr. W. G. Miller
Mr. Frank B. Smith	Mr. Harry Williams

For Two Years.

Mr. W. H. Aldridge	Mr. Thos. Kiddie
Mr. B. A. C. Craig	Dr. A. E. Barlow
Mr. A. M. Hay	Dr. J. Bonsall Porter
Mr. R. T. Hopper	Mr. W. D. Robb

On motion of Mr. Coste, seconded by Mr. Hopper, a vote of thanks was tendered the Hon. Mr. Brodeur for the use of the steamer "Montcalm," and also to the Captain of the steamer, for his courtesy on the excursion of the previous day.

On motion of Mr. Hopper, the Quebec M. & C. Ry. Company were tendered the thanks of the Institute, and a vote of thanks was also passed to the citizens of Quebec for their hospitality on the occasion of our visit.

Mr. Obalski's services, as Chairman of the Dinner Committee, were also a subject of appreciation.

Prof. R. W. Brock, Mining School, Kingston, then presented a paper on "The History of the Rossland District," illustrated by lantern slides, after which Mr. J. J. Penhale presented a set of lantern slides illustrating the asbestos industry, in connection with a paper on that subject by the President. Dr. Porter also showed a number of views from the mining fields of South Africa. This brought to a close the proceedings of one of the largest and most successful meetings in the history of the Institute.

ON THE ADVISABILITY OF THE ESTABLISHMENT OF A FEDERAL DEPARTMENT OF MINES.*

By H. Mortimer Lamb.

HISTORY OF THE GEOLOGICAL SURVEY OF CANADA IN ITS RELATION TO THE MINING INDUSTRY.

So long ago as 1832 a petition praying for the establishment and maintenance of a Geological Survey of old Canada, was presented to the House of Assembly. But although the recommendation received the endorsement of Sir John Colborne, then Lieutenant Governor of Upper Canada, it was not even considered

* This paper was left in an unfinished condition by Mr. Mortimer Lamb, who was taken seriously ill shortly before the meeting of the Institute at which it was to be read, at Mr. Lamb's request it was revised and completed by Dr. Frank D. Adams.

by the Legislative Committee to which the matter was referred. Subsequent petitions met the same fate; until in 1841, the united parliaments, under the administration of Lord Sydenham, voted the sum of £1,500 sterling for survey purposes. In this year, Sir William E. Logan, (then Mr. Logan), who was born in the City of Montreal in the year 1798 and had already won for himself a considerable reputation in Great Britain, for his admirable geological work in South Wales, and his important discovery whereby the question of the origin of coal was established in favor of the theory of growth *in situ*, came to Canada on a visit to his brother residing in Montreal, and impressed doubtless with the great opportunities so new and vast a country offered for original research, signified in a letter written at this time his intention, "provided he could make the necessary business arrangements," of offering himself as a candidate to undertake the geological survey of Canada; "*and," he wrote, "if I once begin it will not be my fault if it does not go ahead." Lord Sydenham while riding near Kingston was thrown from his horse and died from the injuries which he sustained. He was succeeded by Sir Charles Bagot, who after referring the matter of the appointment of a geologist to Lord Stanley, then Secretary of State, for the Colonies, offered the position, on the strong recommendations of such distinguished British scientists as De la Beche, Murchison, Sedgewick and Buckland, to Logan in the spring of 1842, and in August of the same year he entered upon his duties, but for several months his services were gratuitously performed. The actual institution of the survey may then be said to date from the 1st of May, 1843. Mr. Logan's first assistant was Mr. Alexander Murray, (afterwards C.M.G., who subsequently became Director of the Survey of Newfoundland). It may here be noted that from the beginning, great stress was laid on the advantage likely to accrue in the direction of mineral development in Canada as a result of systematised geological investigation. This was in fact, the chief argument advanced by the petitioners to Parliament urging the establishment of the Survey; it was the view taken by Lord Sydenham in his support of the measure; and Logan himself as is evident from the opinions expressed both in his published letters and in his official reports, and equally so by his years of useful work, never ceased to regard this as the paramount aim and object of his endeavors. Thus in a letter addressed to Sir Henry De la Beche, in 1843, he wrote, "The main object of the investigation is no doubt to determine the mineral riches of the colony," and again in his evidence before the Parliamentary Committee on the Geological Survey in 1855, he said "The object of the survey is to ascertain the mineral resources of the country, and this is kept steadily in view. Whatever new scientific facts have resulted from it, have come out in the course of what I conceive to be economic researches carried on in a scientific way. . . My whole connection with geology is of a practical character." In short, as is somewhere stated, Sir William Logan belonged to that school of geologists whose motto is "Facts, then theories." And the reports for which he was responsible attest the accuracy of this claim. For example, in the "Report of Progress of the Geological Survey from its commencement to 1863," over one-fifth of the volume, or close on two hundred pages is devoted to economic geology, specific information being here given in respect to mineral occurrence, location and utilization; while in general the various reports contained in this volume are characterized by the amount of practical information afforded. In 1844 Mr. Logan established in the "Upper Chamber" of his brother's warehouse in Montreal a museum in which to display the large quantities of organic remains and minerals collected by himself and Mr. Murray, during their summer explorations; and still bearing in mind economic requirements, he employed at his own pecuniary risk, a chemist to make the necessary analyses of mineral specimens.

It was not until the following year, Logan having meanwhile drawn heavily on his own resources for the expenses of the work, that, thanks to Lord Metcalfe, the Survey was placed on a better footing, the employment of a chemist was authorized and the grant increased, covering a period of four years, to £2,000 per annum. But even under these improved conditions the difficulties of carrying on the work efficiently were enormous, not only by reason of financial disabilities but on account of the physical obstacles to be overcome. The greater portion of the country was, of course, a *terra incognita*, so that the geologists were obliged to devote the major part of their time in the field to topographical observations. In another of his long and interesting letters to his friend, De la Beche, Logan wrote: "I wish I could let you see the map of our journey across from the St. Lawrence to Bay Chaleur. The length of our winding line is 111 miles, in which we dialled the twists and turns of two rivers, one thirty-five miles and the other sixty-five miles, obtaining the bearings of the reaches by prismatic compass and the distances by Rochon's micrometer, and registering at the same time the quality, contents and attitude of every bed of rock we saw, with barometric heights, etc. The distance between the rivers we triangulated by means of well marked peaks. I think you would say we deserve some credit for it." In later years, he also refers to the time occupied in work of this character. "It will be easily understood," he remarks, "that this geographical work must unavoidably impede the rapidity of geological examination; and the necessity of so much measurement to fix the position of rock exposures, forces us, in order to make even a moderate progress, to examine fewer of them, or to give to each a shorter time than we would like, and thus, perhaps, to overlook some of its characteristics." This point was well emphasized by Prof. Agassiz in his evidence before the select committee above referred to, in which after speaking of the inadequate means placed at the disposal of the geologists, he says, "Topographical surveys, to be satisfactory ought to be founded upon astronomical observations, but who would therefore expect that astronomers should leave their telescopes, go into field, chart in hand, and draw maps. Mining operations bear to geology the same relations, that geodetic operations bear to astronomy. All that may be fairly expected of a geologist, is to prepare a geological map of the province he surveys, and thus obtain the information, without which the mineral resources of a country cannot be satisfactorily ascertained."

At the close of the year 1846 Dr. (then Mr.) Sterry Hunt, who subsequently did so much useful work in connection with the survey in Canada, was appointed to the staff, replacing Mr. De Rottermond, as chemist and mineralogist.

Meanwhile the Provincial Act, passed in 1845, had made provision for the continuation of the Geological Survey for five years only, and the time was drawing to a close. However, not without a delay that interfered considerably with the work of the Survey, the

*Life of Sir William E. Logan—by B. J. Harrington, p. 111. (Montreal: Dawson Bros., 1883.)

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act was finally renewed with the same provisions. In the same year the Government decided to send a collection of Canadian economic minerals to the first of the great International Exhibitions in London, inaugurated by Prince Albert. This collection was prepared and placed in the charge of Mr. Logan, who by-the-way during his stay in London, was called upon to defray his own expenses. The exhibit, which obtained a medal, came in for a great deal of notice and praise, the *Times* referring to it as the most interesting and the most complete of all the collections sent from the British Colonies. While in London, Logan was elected a Fellow of the Royal Society. Up to this time actual geological investigations and examinations had been conducted in the mineral bearing districts of Lake Superior, Lake Huron, their coasts and islands; the Huron-Erie Peninsula; the Ottawa river valley; the Eastern Townships from the Richelieu to the Chaudière; in the St. Lawrence valley, the Island of Anticosti; the Gaspe Peninsula; the north shore of the St. Lawrence for a considerable distance east and west from Montreal and the country between Lake Simcoe and Kingston. By way of contrast it may be noted that whereas in 1857 geological work in Canada—a country then comprising 331,280 square miles—was being undertaken by a staff of two geologists and a chemist, in the State of New York whose area is about 46,200 square miles, a geological staff was employed including four geologists, four assistant geologists and a palæontologist; with an annual grant of £2,000 as against one of $20,000, exclusive of the cost of publications.

In 1854, in consequence of a popular demand that steps should be taken to give a wider circulation to the valuable reports and publications of the Survey and thus make them more generally accessible to the public, a select committee on the Geological Survey was appointed by the Government. The evidence before this committee of Messrs. Logan and Hunt, and of other distinguished witnesses, namely: Prof. James Hall, of the New York Survey; Prof. E. J. Chapman, of University College, Toronto; Mr. Alexander Russell, of the Department of Crown Lands; the Rev. Andrew Bell, of L'Orignal; Prof. Horan, of Quebec, and of Prof. Agassiz, makes very interesting reading and was of a highly complimentary character, but referred to the difficulties under which the survey was working.

Notwithstanding the generally favorable impression which Logan and his work had made upon the people of Canada, there must have been some who were still skeptical as to the advantages which the country would derive from the Geological Survey. The Committee, therefore, did not fail to interrogate Logan closely on this subject. "Can you," they asked, "give any illustration of the manner in which a sound scientific basis leads to practical economical results?" and again, "Have you in your survey as your principal object the establishment of new scientific facts, or has your attention been directed to discovery and pointing out economic advantages?" From Logan's answers to these questions we make the following extracts.

"The object of the survey is to ascertain the mineral resources of the country and this is kept steadily in view. Whatever new scientific facts have resulted from it have come out in the course of what I conceive to be economic researches carried on in a scientific way. . . . . Thus economics lead to science and science to economics. The physical structure of the area examined is, of course, especially attended to, as it is by means of it that the range or distribution of useful materials, both discovered and to be discovered, can be made intelligible. A strict attention to fossils is essential in ascertaining the physical structure. . . I do not describe fossils but I use them. They are geological friends who direct me in the way to what is valuable. One of them who is not yet specifically baptized, helped us last year to trace out upwards of fifty miles of hydraulic limestone. . . . . My whole connection with geology is of a practical character. I am by profession a miner and a metallurgist. A due regard to my own interests forced me into the practice of geology, and it was more particularly to the economic bearings of the science that my attention was devoted."

After hearing the evidence, the committee made the following recommendations:

(1) Republication of a revised edition of not less than 20,000 copies of the reports, with a coloured map.

(2) Publication of the same number of annual reports in future years.

(3) The periodical publication of 3,000 copies of plates and descriptions of fossils, etc.

(4) Gratuitous distribution of reports in certain directions and the remainder to be sold at cost price.

(5) Establishment and maintenance of the museum and library upon an efficient footing.

(6) To provide for the supply of geological and mineralogical specimens to other museums.

(7) The employment of topographical surveyors and their parties to assist in the geological surveys, when judged necessary.

(8) The employment of two or three additional explorers.

(9) The employment of a resident assistant, as keeper of the museum, and in the general business of the office.

(10) The employment of a second assistant geologist, charged more especially with the exploration of mineral localities. (But to this the rider is added: "The committee wish it to be understood that in the present state of the country they consider this the least essential addition to the establishment, and unless ample funds are provided, they would not advise it, to the prejudice of any other of their recommendations.").

(11) The encouragement of voluntary assistance by the publication of questions and short instructions now and what to observe and collect.

(12) Securing the aid of deputy provincial surveyors, and requiring candidates in the future to pass an examination in the rudiments of geology.

(13) The establishments of certain points in different parts of the country, as a basis from which local surveys may be reckoned.

(14) Requiring railway companies to furnish plans and sections of their surveys.

Accompanying these recommendations an estimate was furnished, in which the annual cost of the Department was placed at $6,000.

At the Paris Exhibition of 1855 Canada's collection of minerals, in the charge of Messrs. Logan and Hunt, was very highly commended, and for his services in this regard Logan was awarded a gold medal and presented by the French Emperor with the cross of the Legion of Honour, and in the following year, Her Majesty conferred on him the honour of Knighthood, and the Geological Society bestowed on him the Wollaston Medal, as a sign of their appreciation of his work. On his return to Canada the Geological Act of 1850 had expired, and doubtless apart from the findings of the select committees, the honour shown to Sir William while abroad and the influence he personally exerted upon his return, was to no small degree responsible for the renewal of the Act for a further term of five years and the increase of the annual grant to £5,000.

The years 1860 and 1861 were uneventful in the history of the Survey, but in 1862, under its auspices, another large collection of minerals was exhibited at the London International Exhibition of that year, Sir William Logan being appointed Commissioner. Upon his return to Montreal in 1863, his great volume on the Geology of Canada was completed and published. Meanwhile, as has already been shown, the existence of the Survey had been extremely precarious, on account of its dependence upon an altogether insufficient annual grant. Accordingly Sir William now addressed a letter to the Minister of Finance under the McDonald-Dorion administration, urging in the strongest terms the necessity of more liberal action on the part of the Government.

The fund provided for the maintenance of the survey in 1863 was, he pointed out, exhausted and a certain sum was falling due for the cost of illustrating the report, while the grant of the previous session was insufficient to pay expenses, and allowed nothing for publications. He had, in fact, not only disbursed $4,000 out of his own pocket in the purchase of works for the library, surveying instruments, etc., but in order that the work should be carried on during the year, Parliament having dissolved without granting supplies, he actually advanced the necessary funds, amounting to upwards of $10,000, for the purpose. Shortly after this letter was written a change of Ministry occurred and the Act making provision for the Survey was again renewed for another period of five years. Nothing of notable importance appears to have occurred until 1866, when another mineral exhibit, which was instrumental in attracting much attention to Canada, was sent to Paris in charge of Dr. Hunt and Mr. Richardson.

Early in 1869 Sir William Logan resigned the Directorship, and was succeeded by Mr. (afterwards Dr.) A. R. C. Selwyn, an English geologist, who for many years had directed the Geological Survey of Victoria, Australia. Mr. Selwyn, however, does not appear, judging from his earlier reports, to have devoted as much attention to the subject of economic geology as his illustrious predecessor, although in the Report of 1871-72 some valuable information is afforded by Mr. Richardson on the coal fields of Vancouver Island, and by Mr. Vennor in connection with the occurrences of iron and apatite in the Counties of Leeds, Frontenac and Lanark, and of gold in the Township of Marmora. In this year also a first attempt was made to compile mining statistics, figures being given for the three years, 1869, 1870 and 1871. In view of the great developments that have since taken place it may be of interest to quote from these returns. Thus the average annual production at this period is stated as follows:

Name of Province.	Value of Product at Mine.
Ontario	$996,982
Quebec	330,209
Nova Scotia, (coal)	1,192,365
Nova Scotia, (gold)	351,266
Nova Scotia, (other minerals)	220,000
New Brunswick	262,288
Newfoundland	233,702
British Columbia (gold)	1,336,066
British Columbia (coal)	151,952
Total annual average	$5,044,830

On the grounds, however, that mine owners neglected to make the returns asked for, no further attempt was made to continue this useful work until many years later. The volumes of 1874-5-6-7 are largely scientific in character, much space being occupied also with somewhat trivial details recounting incidents of camp life and travel. Mr. Selwyn, however, appears to have shared the views of Sir William Logan in respect to the importance of exploration in the iron and coal fields of Nova Scotia and Cape Breton, for in the Report for 1874-75, he explains that unusual attention has been devoted to geological work in Nova Scotia, as "the development of coal and iron mines exerts a far greater and more beneficial influence upon the material progress and prosperity of the country than can be ascribed to that of any other product of mining industry." At the same time he complains of the inadequacy of his staff and the urgency of better provision in this respect, pointing out that two-thirds of the time and attention of explorers was then being occupied in making topographical measurements for the construction of the essential preliminary maps.

In 1877 "An Act to make better provision respecting the Geological and Natural History Survey of Canada, and for the maintenance of the Museum in connection therewith," was passed by the Dominion Parliament, but while the scope and objects of the Department were enlarged, so as to include various branches of natural history, there was at first no corresponding increase in the appropriation granted. This was subsequently remedied, and the Survey commenced to take up natural history work of various kinds, but still showed little disposition to assist the miner in a practical manner. At length, after the issuance of what happened to be a very meagre report for the years 1880-81-82, complaint became so general that a select committee was appointed by the House of Commons to obtain information as to the methods adopted by the Geological Surveys in Canada and other countries in the prosecution of their work, with a view of ascertaining if additional technical and statistical records of mining and metallurgical development in the Dominion should not be procured and given to the public. After hearing the evidence, the committee published a lengthy report, from which the following extracts are taken:—

"The committee........notices the serious lack of attention to the mining industries of the country in actual operation. Under the administration of Sir William Logan, but little progress had been made in actual mining developments, particularly in the limited sphere of his labours—the present Provinces of Ontario and Quebec. Since his day, not only has the field of practical mining been greatly enlarged by the addition of the Maritime Provinces with their extensive coal and gold mines in actual operation, but in the previous fields we have to note the discovery and development of the iron and gold deposits in Ontario, the phosphates of Kingston and the Ottawa Valley, the gold of the Chaudière district and the copper, iron and asbestos deposits of the Eastern Townships, yet we look in vain in the present report for any information, either of a statistical nature of their production, or of a descriptive or geological character, as to their progress or peculiarities. Thirteen pages of the last report suffice to narrate the work of the Survey for the last two years, in connection with the mines in actual operation in the whole Dominion. . . In the opinion of the committee, the primary object of the Survey should be to obtain and disseminate, as speedily and extensively as possible, practical information as to the economic mineral resources of this country, and scientific investigations should be treated as of only secondary importance, except when necessary in procuring practical results."

In concluding their report the committee strongly recommended the appointment to the staff of the Survey of a duly qualified mining engineer, whose special business it should be to keep himself and the public informed as to all mining developments and progress, and to procure and preserve full statistical information in respect thereto.

But it may be stated in fairness, that this very report which came in for much unfavourable comment and criticism, contained an account by Dr. Dawson of the discovery and value of the Crow's Nest coal area, probably one of the most important announcements of an economic character ever made by the Survey.

It is to be noted also that in his summary report for 1885, Mr. Selwyn refers to the publication of thirty-seven reports, signifying by their titles their special bearing on mines, mineral deposits and statistics of mineral production, while special examinations of mining districts were begun in 1883 in the Lake of the Woods gold region, the phosphate region in the townships of Wakefield and Templeton; and, in 1884, in the Marmora gold and iron bearing region, and the mining region around the north shore of Lake Superior, as well as in some of the Quebec mining districts. The investigation by the Parliamentary Committee appears, however, to have served some useful purpose, inasmuch as a Mines Branch in the charge of Messrs. Coste and Ingall was afterwards established, and a first and comprehensive statistical report issued in the volume for 1886, in which the total value of the mineral production of Canada for that year is given as $10,529,361. In the preceding volume, Mr. Coste also contributed an interesting paper entitled "Observations on Mining Laws and Mining in Canada, with suggestions for the better development of the mineral resources of the Dominion," and many of the comments in regard to the defects in the law of that time, apply with equal point and force at the present day. The annual reports from henceforward certainly show that a greater interest in mining developments was being taken by the Survey than formerly; and a great deal of valuable information bearing on this subject is made available. Although the Klondike excitement did not eventuate until nearly ten years later, the Survey as early as 1887 called attention to the gold potentialities of the region in a report written by Dr. Dawson, who had associated with him on his expedition, as assistants, Messrs. McConnell and McEvoy; while in addition to useful facts secured by Dr. Bell relative to the Sudbury district, by Mr. F. D. Adams and in the Laurentian country, Dr. Ells in the Eastern Townships, and by Mr. Bowman in Cariboo district, B.C., special investigations in the mining districts were undertaken by Mr. Ingall of the Mines Section. In Part II of the Report for 1887–88 also appears Dr. Dawson's most valuable treatise, on "The Mineral Wealth of British Columbia," which to this day is in frequent request; while in the following year Dr. R. W. Ells reported very fully on the Mineral Resources of Quebec. In the spring of 1889, Mr. Coste resigned charge of Mineral Statistics Division, and was succeeded by Mr. E. D. Ingall.

In 1890, a new Act was passed repealing the Act of 1877, in which the duties and objects of the Survey were set forth as follows:—

(*a*) To make a full and scientific examination and survey of the geological structure, mineralogy, mines and mining resources of Canada and of its fauna and flora;

(*b*) To maintain a museum of geological and natural history and arrange for exhibition such specimens as are necessary to afford a complete and exact knowledge of the geology, mineralogy and mining resources of Canada;

(*c*) To collect and publish full statistics of the mineral production and of the mining and metallurgical industry of Canada; to study the facts relating to water supply. . . and of mines and mining work in Canada.

The Act also constituted the Geological and Natural History Survey a separate department, instead of a branch or sub-department of the Department of the Interior. In calling attention to a provision in this Act by which no persons unless science graduates of recognized schools or colleges may be appointed to the staff, Dr. Selwyn in the report of 1890–91, comments as follows:—

By these provisions "it is hoped to maintain the efficiency and high scientific standing of the department, but in order to insure this desirable result a scale of remuneration should be established in the department, more in accordance than it is at present with that which obtains elsewhere, and even in other departments of the public service and in the universities of Canada, for acquirements and experience such as is required of the technical officers of the Geological Survey, and in view of the risks, hardships and responsibilities they are often called upon to undertake." This representation is alluded to in passing, as it is a grievance of a very real nature which still exists, and it is hoped may in the near future be remedied.

In connection with the collection of mining statistics it may be mentioned that in 1891 an attempt was made to seek the co-operation of the Provinces, and thanks to the good offices of Mr. John Robson, then Provincial Secretary, the endeavour met with ready response in British Columbia. In this regard Mr. Ingall in his report for 1892 writes "The confidence of the mining community . . .now gained, has resulted in an increasingly hearty response to our circulars," and this statement is borne out by the exceptional value and comprehensiveness of the report of the Division of Mineral Statistics and Mines at this date.

In January, 1895, Dr. Selwyn resigned the directorship of the Survey, and was succeeded by Dr. George M. Dawson. Much more attention was now being given to mining developments, and the first annual report for which Dr. Dawson was responsible is of unusual interest. Thus, an account is given of borings undertaken for petroleum under the auspices of the Survey, at Athabasca Landing; Mr. McEvoy reports on recent developments of economic minerals in the Kamloops area, and refers to the occurrence of cinnabar at Savanas. He also describes his observations on hydraulic mining in Cariboo. Mr. McConnell gives a statement of the characteristics of the important mines of West Kootenay; Mr. McInnes reports of the occurrence of economic minerals near Sault Ste. Marie; Dr. Ells describes the occurrences of iron, galena, ochre and mica in the counties of Ottawa, Pontiac and Carleton; Mr. Low calls attention to discoveries of hematite and siderite in the Labrador Peninsula; Mr. Fletcher refers to iron and coal developments in Nova Scotia, while Mr. Faribault's report on gold in this Province is of great practical value. This gentleman in speaking of quartz mining in Nova Scotia, points out that the gold-bearing deposits in that Province are really in the form of saddle veins on anticlinal folds and shows that on a proper recognition of this fact largely depends the success and future of deep gold mining in Nova Scotia. He also advises the adoption of a method of mining followed in Bendigo, where the occurrences are of a very similar nature, which consists in sinking perpendicular shafts on the anticlinal axis from which cross-cuts and levels are driven to intersect the interbedded saddles. Mr. Ingall, reporting in this volume, complains however that the funds placed at his disposal were insufficient for the prosecution of important mining work which had been initiated by the Mines Section.

In 1895, the Survey undertook a new duty in supplying small typical collections of Canadian minerals and rocks to educational institutions in Canada, and no less than fifty-nine collections of this kind, embracing 6655 specimens, were furnished. In addition, the excellent work of the previous year was extended along similar lines.

In short, during Dr. Dawson's all too short term of office as Director of the Survey both his own-work in the field and that of the department generally was of an eminently useful and practical character. This is well pointed out by Dr. F. D. Adams in his "Memoir of George M. Dawson," *where he states "his work . . . . contributed largely to great development of the mining industries. . . during recent years, for his reports, though thoroughly scientific, always took account of the practical and economic side of geology, and accordingly commanded the attention and confidence of mining capitalists, mine managers, and others interested in the development of the mineral resources of the country." Dr. H. M. Ami, in his appreciative biographical sketch also refers to the consideration given by Dr. Dawson to economic work "Through his personal efforts," he writes, "and that of his staff, he did so much to disseminate information regarding Canada's mineral resources, that the mining interests of the Dominion may now be said to be fairly well established upon a firm and non-speculative basis."

Dr. Dawson died suddenly on the 2nd of March, 1901. And from that time to the present the Survey has been without a Director. These duties, however, have been performed by Dr. Robert Bell, who as Acting Director, has had the responsibility of the work, but neither the honour nor the emoluments which should go with it. Under Dr. Bell much work of great value has been done by the Survey; but in its relation to the mining industries it is necessary to add that the present system, which remains practically the same as that followed a quarter of a century ago, is by many, competent to express an opinion, regarded as antiquated and inadequate having regard to present requirements, the growth to which the mining industry has since attained, and the important position it now occupies. And by contrasting the methods adopted by the United States' Survey with those still followed by our own, this complaint appears to have certain justification. Taking, for the sake of example, one branch, the Mining and Statistical Division of the Survey, it is impossible to truthfully assert that its scope or usefulness has been greatly, if at all, extended since the date of its inception. In fact it is currently believed that the officer in charge of the branch has received little, if any encouragement at any time to special effort in this regard. The geological reports themselves too, although frequently of great value from an economic point of view, are with some exceptions, still somewhat unsuitable for general circulation, since they rarely contain the practical details and facts in that readily accessible form which the busy man of affairs, contemplating an investment in any one of our mineral industries is desirous of having placed at his disposal.

*Bull. Geol. Soc., Am. Val. 13, 1901.

THE ESTABLISHMENT OF THE MINES BRANCH OF THE DEPARTMENT OF THE INTERIOR.

It was doubtless in consequence of a realization of the requirements in this respect that the Government in July, 1902, established in connection with the Department of the Interior, a Mines Branch, in charge of Dr. Eugene Haanel, Ph.D., who received the title of Superintendant of Mines. The establishment of the Mines Branch did not include a statement of its functions, but a memorandum suggesting the lines on which organization should proceed, was prepared and presented to the Minister.

The work to be accomplished by the Department would, the memorandum states, most conveniently be distributed among the following sections:—

1st: *Mineral Resources*.—The general object of the work of this branch to be the collection and publication of data regarding the economic minerals of the country and of the processes and activities connected with their utilization. This to be accomplished under the following two heads:

(a). *Statistics*: Covering the investigations into (1) the production, consumption, exports and imports of the economic minerals of the country, (2) the collecting of figures relating to costs, freight, markets, etc. These tabulated on a proper system of classification, with discussions as to the causes of variation of production, exports and imports, fluctuations of market, etc., should be published annually, or at such frequent intervals as may be found practicable.

(b). *Technological*: Covering the preparation and publication of bulletins and monographs giving information in a concise form regarding (1) the location, mode of occurrence, extent and character of the various economic mineral deposits, (2) assays and analyses of ores and in the case of building material, tests of strength and endurance of pressure, etc., (3) description of the method of exploitation, treatment for extraction of metallic contents, or resultant products. The information to be obtained from material already published, but scattered and in a great measure inaccessible, to be supplemented wherever necessary by visit of officer in charge to the respective localities. A separate monograph for each mineral, as coal, iron, copper, nickel, gold, etc. (except building materials which may be written up as a class to be published, giving all available information in reference to them. The publications specially framed to meet the needs of the public commercially interested in these matters and annually bound in one volume, entitled "The Mineral Resources of Canada." The separate monographs to be distributed as widely and freely as possible to bring the mineral wealth of Canada prominently before the investing public and thus aid in bringing capital into the country, necessary for the development of its resources.

2nd: *Mining Geology*.—Covering the investigation of mineral areas and mining camps, determining the mode of occurrence, extent and character of the ore bodies and furnishing to the practical miner clues regarding the probable direction in which to exploit his property, and by a careful study of the associated rocks and their relation to the ore bodies establishing principles which shall be helpful as a guide regarding the occurrence of similar ores in other regions. This to include the preparation of good topographical and geological structure maps of important mining districts.

3rd: *Metallurgy, Assaying and Chemistry.*—The personal of this section would be occupied in assaying the ores and first marketable products of mines collected by the mining geologists, and performing such rock-analyses as may be required by the mining geologists for purposes of determining the composition of rocks in association with the ore deposits.

The further work of the section would consist in analysing such material as may from time to time be sent to the Mines Branch from outside parties.

CONCLUSIONS.

This historical survey brings us down to the present time and to review the economic work accomplished by the Survey in a few words, it may be said that practically all the information which we possess concerning the mineral resources of the Dominion has been collected by the officers of the Geological Survey, with the exception of that which we owe to the Provincial Mining Bureaus of British Columbia and Ontario, and to the Mines Branch of the Department of the Interior, all of which have been established within the last few years. But while the Survey has been immense value in the development of the country, the establishment of a separate Mines Branch in the Department of the Interior may be held to indicate that in the opinion of the mining men of Canada the Survey has not in recent years, on its strictly economic side, kept pace with the growing requirements of the mining industry, and that the immense mass of information which it has collected has not been reduced to a sufficiently accessible form.

In this connection, however, it must be noted, that with the exception of experimental metallurgy, every line of work which is set forth as within the purview of the Mines Branch, has been already taken up or is now being prosecuted by the Geological Survey of Canada. In making this statement it must be clearly understood that there is no intention, in what has been said, to minimize the value of the work accomplished by the Mines Branch of the Department of the Interior since its inauguration, but merely to point out that, while by means of a large special grant placed at its disposal the Mines Branch has been able to produce a number of reports of marked economic value, the production of such reports does not demand the existence of such a separate bureau. Given a properly reconstructed Geological Survey, of which the present Mines Branch might form part, it could employ the same extra grant with at least equal economic efficiency.

Such work of the highest quality, is being carried out on an enormous scale by the Geological Survey of the United States, which working in the territory immediately south of us, has to deal with conditions which resemble very closely those obtaining in Canada at the present time. Moreover the work done by this Survey has so emphatically commended itself to the mining interests in the neighbouring Republic that the Government have repeatedly extended the scope of the Survey and greatly increased the sum appropriated for its use.

As a matter of fact, our mining community in Canada, while admitting that the Geological Survey of Canada has accomplished an immense amount of good work in times past, points to the immense increase in the volume and value of the mineral output of Canada as shown by the following figures:—

TABLE SHOWING MINERAL PRODUCTION OF CANADA.

	Value in Dollars.
1871	5,044,830
1887	10,221,255
1887	11,321,331
1888	12,518,894
1889	14,013,913
1890	16,763,353
1891	18,698,953
1892	16,628,417
1893	20,035,082
1894	19,931,158
1895	20,648,964
1896	22,584,513
1897	28,661,430
1898	38,697,021
1899	49,584,027
1900	64,618,268
1901	66,339,158
1902	63,865,797
1903	62,532,210
1904	60,343,165

It also points out the present position which the product of the mine holds, as compared with the agricultural exports of the Dominion, as shown by the following figures:—

TABLE SHOWING THE AGRICULTURAL EXPORTS OF THE DOMINION.

	Value in Dollars.
1896	39,659,686
1879	46,377,927
1898	68,919,688
1899	62,528,107
1900	73,281,760
1901	66,872,292
1902	80,705,186
1903	99,420,195
1904 (about)	98,300,000

In view of these figures and of the fact that the agricultural interests of Canada have been and are being enormously developed by the Government, through the Department of Agriculture under the charge of a special minister of the Crown, our mining men ask why the great mining interests of the Dominion might not be similarly cared for.

It is not here necessary to enumerate the many ways in which the Governments of other countries do, and our Government could, actively assist in the development of mining industry. Our views on this matter have already been set forth in a paper read before this Institute and printed in one of the volumes of our Transactions. (Jour. Can. Min. Institute, 1902, pp. 585–595). Our aim here is merely to point out that the mining industries of Canada might at the present time be greatly assisted if the work of the Geological Survey and the Mines Branch of the Department of the Interior was taken up seriously by the Government, correlated, systematized, extended, and made to conform to modern requirements. The duplication which now exists would thus, in the interests of economy, be avoided and the whole work would be put upon a proper businesslike basis.

If this were done, it is certain that the mining interests of the country would be well served and that the action of the Government would receive the hearty endorsation of everyone interested in mining and that furthermore, as the value of the work became increasingly evident the Government would feel justified in providing additional means for its prosecution, so that a larger staff of properly paid and thoroughly efficient men, *au fait* with the modern methods and results of science as applied to the study of these economic problems, could be permanently employed by the Government in the development of the mineral resources of our country.

All Canadians would be sorry to see the Geological Survey of Canada lose its independent existence, seeing that it is a branch of the service of which, with all its faults, we Canadians have reason to be proud. But if the happy result above indicated could be insured by the appointment of a Minister of Mines who would have direct supervision of this work, the expansion of the Geological Survey into a Department of Mines and Geological Survey, would receive the support of the whole mining community.

THE EDUCATION OF MINING AND METALLURGICAL ENGINEERS.

By Professor JOHN BONSALL PORTER, Ph.D., D.Sc.

Until a comparatively recent day Engineers as a body have shown little interest in what may be broadly termed Engineering Education, and have left it to the Universities and Technical Schools to formulate and carry out such schemes for training young men as they have seen fit. There have of course been notable exceptions and many Engineers of the highest rank have given invaluable advice, assistance and sympathy, but the general feeling of practical engineers and perhaps particularly of Mining Engineers to teachers of Engineering has been more or less unfriendly.

Under these conditions the natural tendency of professors to become pedantic was not sufficiently neutralized, and although the public demand for advanced education led first to the foundation of professorships in engineering in each of the great Universities, and later to the development of special faculties and schools of Engineering with elaborately differentiated departments covering the several branches of the subject; yet, in general the methods of teaching remained somewhat academic to say the least.

It is but a very few years since it was possible, or even quite a matter of course for young men to be granted University degrees in Mining Engineering without even having seen a mine, and in other branches of Engineering the situation was no less absurd.

The so-called Summer School established twenty odd years ago by Columbia University and adopted (usually as an optional course) by several other Mining Schools was the first and most important move in the right direction. The equipment of Engineering Laboratories and later of special laboratories of ore dressing and metallurgy, was almost equally useful; and now every school of importance is provided with laboratories, and offers its students so called practical and experimental courses in many branches of engineering.

These changes and the introduction of manual and technical training in both elementary schools and colleges have met with approval from practical engineers, and during the last few years the technical journals and the Transactions of Societies have contained a great number of papers on Engineering Education. Further practising engineers and works managers have displayed interest in the education of young men and have shown a far greater willingness than heretofore to admit students to their establishments and to offer employment to engineering graduates.

This general interest in technical education is most gratifying to those professionally engaged in engineering teaching and is bound to result in great good, but it is not without its dangers.

The practising engineer, no matter how thorough his own education has been, usually finds little or no direct use in his practise for higher mathematics and for the pure sciences, and he fails to realize the immense part played in his own intellectual development by the study of these subjects. On the other hand he is constantly concerned with technical details and naturally looks with approval on any school which turns out men ready with facts and figures for immediate use. His influence is therefore almost always in favor of technical as compared with scientific education.

For somewhat similar reasons the majority of engineering students—at least in North America—are very keen to work at studies which have direct and obvious bearings on their future profession, and are grudging of time given to pure science. They fail to see why in a mining course, for example, mining itself should be assigned fewer hours of study than certain other subjects, and why all professional subjects together should occupy but one quarter of their course.

Similarly, many managers and even thoroughly educated engineers in judging the comparative merits of young men seeking employment, naturally prefer those who have a maximum of technical knowledge and can at once be made useful to men whose knowledge is more general.

Under these influences the engineering courses are being somewhat rapidly modified even in the more conservative schools. As a whole the changes are for the better, but, at the moment it is probable that in this country at least, too great weight is being given to the technical side of education. Certainly there is great confusion in the minds of many laymen and some teachers between Science and Technology. How to do a thing is taught rather than why to do it, and in the stress and rush of filling students with facts the infinitely more important business of teaching them to think is almost forgotten.

This utilitarian tendency is shewn most fully in the Correspondence Schools which have sprung up within the last few years and now number their students by hundreds of thousands. These schools have largely taken over the work once attempted by night schools, mechanics classes, etc., and as a whole do it admirably, but they are unfair to their patrons in that they often ignore or make light of difficulties and give their students a somewhat exaggerated idea of the completeness of their own knowledge. The young men who take these courses are rarely able to spare the time and money necessary for a University education and what they do learn is therefore all to the good, but it is unfortunate that these schools so often fail to make it clear to the students that purely technical knowledge is after all only half knowledge, and that the highest achievements in engineering are only possible for men who are thoroughly familiar with the principles of the pure sciences underlying all engineering practice.

Technical schools and similar institutions usually occupy a position in advance of the Correspondence Schools, but generally speaking their standards of admission and of class work are comparatively low, and it is left to the more conservative Universities and to certain exceptionally thorough technical schools to provide the highest type of engineering teaching.

This teaching should be in general very similar for all branches of engineering. The preparatory work should include good elementary training in the usual school subjects, in elementary mathematics and in at least one modern language. Latin is also very desirable, and last, but far from least, the students should be able to write English accurately and clearly.

Assuming this preparation to be of the standard of the best Canadian and American schools, the engineering course should then take four years, two of which can be devoted with advantage to Advanced Mathematics and to Physics, Chemistry, Geology, etc. With these pure science subjects there may be a certain amount of elementary shop work intended not to fit the men to be mechanics, but merely to familiarize them with materials of engineering and with the elements of shop and foundry practice. Time must also be found for mechanical drawing and some sketching.

The long vacations should also be utilized in part for further shop experience in real works, or, in the case of mining students, for labourer's work underground, and for field classes in surveying.

The two final years may then be given with safety to more technical studies. Pure mathematics being now sufficiently in hand its engineering applications to structures and machines are considered under the heads of Applied Mechanics and Machine design. The elements of electrical and mechanical engineering are also essential to all engineers, and miners need also elementary Metallurgy and Mineralogy. The studies in chemistry and geology must also be extended, and laboratory work must be done in the one and field experience gained in the other.

The main part of the work last outlined can be done in the third year of the course and a portion of this year and almost the whole of the fourth can be given to what may be called "professional work," that is to say to special studies in the branch of engineering chosen by the student. In the case of Mining and Metallurgical students the various branches of mining and ore dressing and of advanced work in metallurgy may be included.

It is obvious that no very elaborate detail can be taught in Technical courses which have to be carried through in a single year or at best in a year and a half, but elaborate work is not needed in engineering classes. The essential thing is to get students in the way of thinking as engineers, and to familiarize them with the general principles and fundamental problems of their profession. It would be impossible in one year or indeed in ten, to teach a student the detailed technology of the whole of his selected branch of engineering and it is obviously rarely possible to select the particular part which he will afterwards practice. It is however quite possible to give an intelligent young man a general view of the subject, and then to teach him the technology of a limited number of carefully selected typical processes, and if he knows these thoroughly he will have no difficulty later in learning whatever special processes he is called upon to use. In other words if a man is taught to think as an engineer and to work as an engineer in any one branch of mining or metallurgy, he can whenever necessary quickly qualify himself for any other branch when the circumstances make it necessary.

In what has been said above, practical work, summer schools, and laboratory experiments have been mentioned, but it remains to discuss them at some length. The student of engineering should at an early period in his course have some training in shop work on the ordinary materials of construction. He will not be able to spare time enough to become a skilled workman or even a half skilled apprentice, and he must be made to understand this clearly; but he can and should work long enough to know something of the use of tools, and to understand the qualities of the materials of construction which he is about to study theoretically. This elementary shop work is often carried out in work shops connected with the schools and universities themselves, and frequently can be done in the afternoons of days, the mornings of which are given to more academic studies. This method is economical of time and there are many advantages in having the teaching and shop work under the same direction, but unless a boy is to get thorough practical training later, it is better for him to go to an ordinary shop where he should be required to work full time each day under ordinary shop discipline. In no other way can he be made to realize what work really is; the intimate acquaintance with workmen is also very useful.

This shop work if done outside of the school can usually be arranged for the long vacation.

This shop work can usually be arranged for the long vacation, which should be long enough to give time for it, and for a reasonable holiday. Two periods of two or three months each in two successive vacations should suffice for an ordinary boy, especially as practical technical training is also required at a later period in his course. This latter technical work is even more important, in my opinion, than the shop experience. It should, if possible, follow the general science teaching, and precede the specialisation. The students should first be taken into the mines in a body and be given an opportunity to visit and study works under the guidance of a staff of competent instructors. After a month or two of this field work, each student should obtain bona-fide employment in some works in his chosen speciality, but the exact nature of the work is of no very great moment, so long as it is good engineering work, done by good workmen intelligently directed. The important thing again is to get the student in touch with real work and real wage-earners, and to give him an idea of scale. The elementary shop work may be done if necessary at convenient times in a school workshop, but this technical work must be real in every respect. The student should, for the time being, become a plain workman on wages, responsible to his foreman for certain duties, and liable to penalty or discharge for cause.

The time to be given to the work must depend on circumstances. Three months under the right sort of foreman, in a small but interesting mine or works, will teach as much as a year of ill-directed drudgery. Furthermore, students differ greatly in the readiness with which they take to practical work. Some are the better students for having had many years of hard apprenticeship; but very frequently the man who has spent even one year in practice finds it difficult to return to his classes He is earning money at work, and can often ill-afford to give it up, and again become dependent on his people. Study also often proves irksome, and sometimes very difficult, after a man has been actively employed in work. As a result, many men fail to return to their final studies, and thus lose what should be the most useful part of their education.

If a definite time for practical experience must be set in advance, it is probable that two periods of about four months each in different works, or one period of a year, would be about right; but in this, as in all other matters of technical education, it is far better to make the regulations somewhat elastic in respect of field work and advanced study. Much time can be saved the students, and their work made more effective, if each case is separately considered by the responsible head of their school.

This last and most important period of practical training should follow the elementary engineering studies and if possible come between the third and the fourth year in a four years' course. From it the student comes back to his work with fresh enthusiasm yet without having got out of touch with academic methods as he would have done had he spent a longer period at work. He now enters on his advance work and the teaching may be highly specialized and quite technical, but care must be taken to keep fundamental principles in sight, and the detailed technical work should be carefully laid out to cover only certain important typical operations. This academic work can be made much more interesting and effective by the free use of technical laboratories, in which engineering machinery (and in our case ore-dressing and metallurgical apparatus) can be used; but here, as in the lecture room care must be taken to teach principles, not processes. Certain processes must of course be used, and a good deal of careful detailed work done; but the primary purpose must always be to teach general principles, and mere technology must be kept in a secondary place.

The best function of laboratories, aside from the limited use necessary to illustrate fundamental principles, is to develop the individuality of the students. Each man should be given certain carefully selected pieces of independent work, and he should be encouraged to attack the task in his own way. One or two comparatively heavy investigations are far better than many short experiments, and the instructor in charge can often do his men far more good by showing interest, and yet letting them work out their own salvation whenever possible, than by being too ready to set up apparatus and smooth over difficulties. This advanced individual work can utilize to the full the resources of even the most magnificently equipped laboratories; but care should always be taken especially in schools which are very rich in practical apparatus, to see that the students should do a few things thoughtfully, and with a clear apprehension of their bearing, rather than that they should get shallower experience of many processes and machines.

In connection with this advanced study the men should be taught to write up their work, and to apply the knowledge gained in works, laboratories and lecture rooms, to some practical problems in engineering. In this, questions of estimates and costs should be considered for the men are now about to go out into the world, where costs form an essential element in every enterprise. Estimates made even by advanced students are likely to be far from right, but their preparation gives the men extremely valuable experience, and a competent instructor can do excellent work by discussing economic matters with his men in this stage of their training.

This should end the school course in engineering, for no amount of mere teaching will turn a boy into an engineer, still less into a mining engineer. If, however, he is given a good grounding in science and the principles of engineering, then put in touch with practical engineering work, and finally taught the elements of the technology of his subject, he will be prepared as well as any school can prepare a man to go out into the world and learn to become a good engineer.

Such a course of study as has been outlined above is very different from the old-fashioned course in Mining, and in fact is different in some respects from any course in Mining offered at present, although many schools approach it, and each year sees changes made which bring our science courses closer to this ideal. In this connection the author takes the liberty of briefly outlining the course in Mining and Metallurgy offered by his own University, not because he believes it to be by any means perfect but because it illustrates very well the modern practice in engineering teaching.*

At McGill University students are required when entering to show a good knowledge of mathematics, of one modern and if possible one ancient language and of the usual English and general subjects of the higher schools. They are then required for two years to devote their time to advanced mathematics, physics, chemistry, elementary mechanics and surveying. They also give a great deal of time to drawing and to shop work. In addition to their studies in the University they are required to do one month each year of extra mural work in surveying.

Up to the end of the second year, all engineering students take the same course, after that differentiation begins, mining and civil engineers giving more time to surveying and surveying field work, while electrical and mechanical engineers spend additional time in the drafting rooms and machine shops.

In the third year in the Mining and Metallurgical courses, lectures are given on the elements of Mining Metallurgy and ore dressing and final work is done in the more general engineering subjects.

At the end of this year the class is taken to the field and five weeks are spent in studying mines and metallurgical works under the personal direction of the staff of the department. The district visited is carefully chosen with a view to offering the students the best possible opportunities for observation, and the method in general is to first spend ten days or a fortnight in one particular mine or works, thus familiarizing the students with the plant and making them quite at home in it. The remainder of the period is then spent in visiting other works, one or two days being given to each and the differences in method, etc., noted and studied.

During these excursions, which are ordinarily carried out in a private car chartered for the purpose, students and staff live together, and informal lectures and discussions are held whenever practicable, in order to call the attention of the men to the salient points of interest.

While this class work is going on arrangements are made with the managers of the works visited to take on individual students for the remainder of the summer as workmen. In this way it has always proved possible to provide employment for all men who have not already secured engagements for the summer, and at the end of the field school the class disbands, not to play for three months, but to go to remunerative individual work.

On the return to the University in the autumn the detailed technical and laboratory work already referred to is seriously begun.* Certain typical operations are performed by the whole class such as a stamp mill run, the concentration of a lead or copper ore, and a short campaign with a copper or lead blast furnace, by the whole class, but the main work of the succeeding six months is individual and each man is encouraged to take up the same investigation which is especially interesting to him, such as the concentration of the ore from some mine in which he hopes to obtain employment, or the smelting of a particular material, etc. This individual work, whatever it is, is under the eye of competent instructors, and assistance is given when needed, at the same time and when possible in the same connection, he is required to design a works and to prepare approximate specifications and estimates as already outlined.

In a recent paper by Dr. Stansfield† the method of

* The illustrations accompanying this paper need no description beyond that printed on the plates. They are chosen with a view to illustrating the character of the Ore Dressing and Metallurgical laboratories alone and do not by any means cover the whole equipment of the department, much less of the course as a whole.

* In the appendix will be found a copy of the instructions given to students at the beginning of their elementary work. The more special advanced work is similarly covered wherever possible by instruction papers which need not be repeated here.

† Can. Min. Inst., Vol. IX, 0906.

laboratory teaching in Metallurgy is admirably set forth in detail. The method employed in the Mining and Ore Dressing Laboratories is so similar that it need not be more fully described here.

The University course thus closes with a year of work as practical as possible, yet so laid out and directed as to be theoretical as well. The student is thus prepared to go out into his profession. His education is however but half over, and if he wishes to achieve high success in the end, he must content himself with a subordinate post for many years, and work hard and patiently to master the details of his special business, to learn to command men and to know himself.

An appendix to this paper, entitled "Laboratory Notes on Trial Runs in Ore Dressing," has been omitted owing to lack of space.

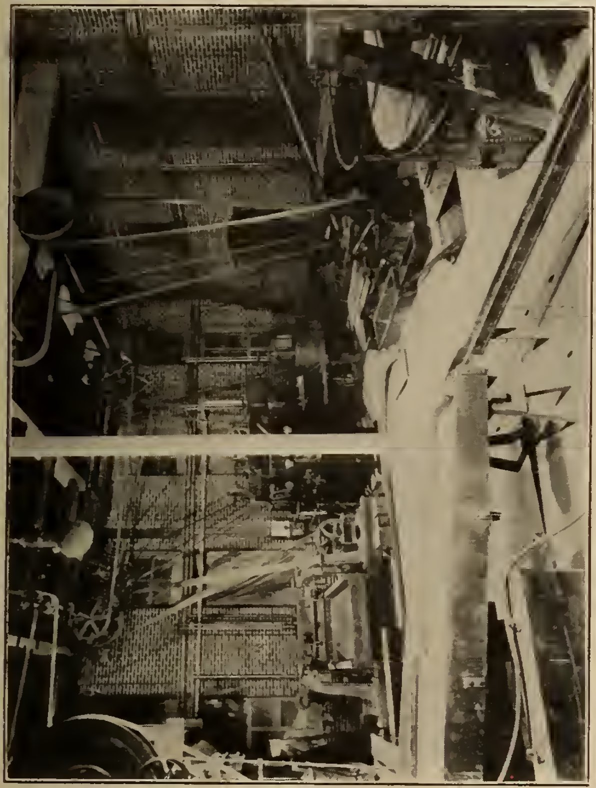

FIG. 2a.—Plates, Tables, Amalgam Pans, etc. Nos. 37a, 31, 49, 41, 43, 48.

FIG. 2b.—Sampling Floor, Crushers, Rolls, Elevators, and Jigs, Nos. 1, 2, 3, 12, 20.

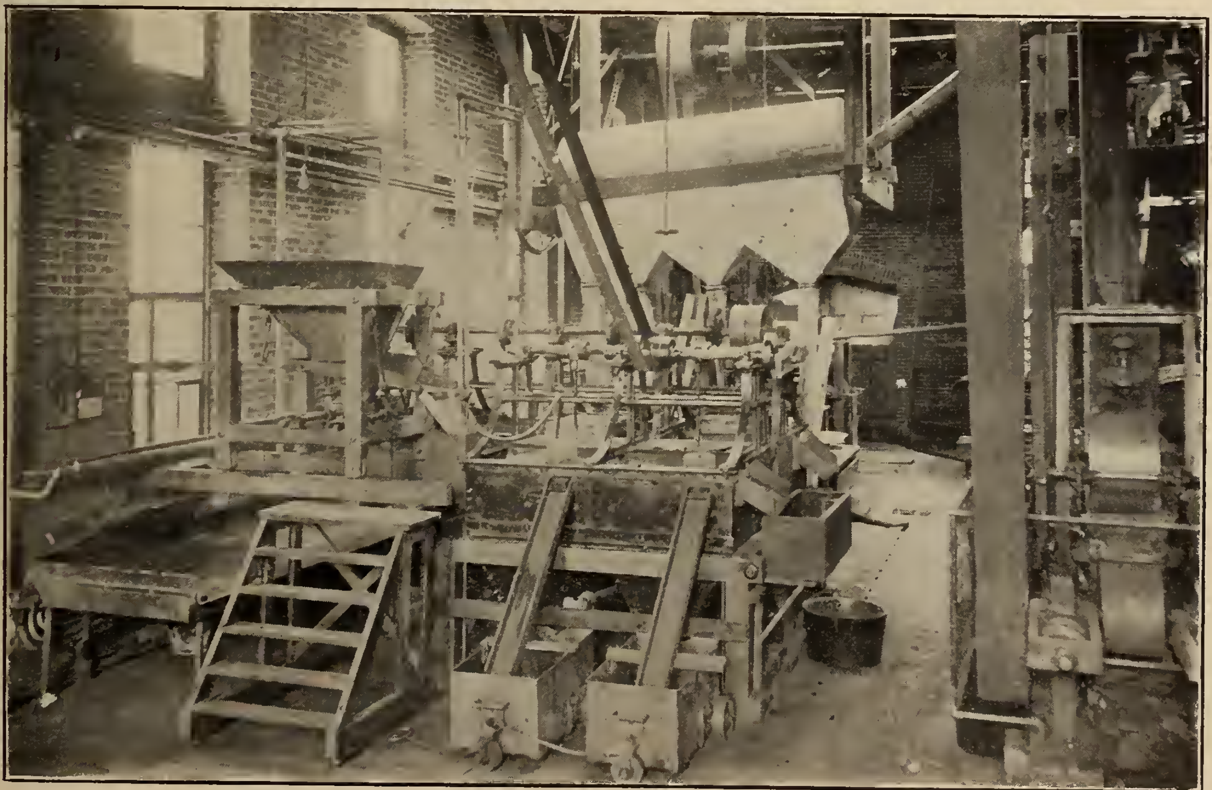

FIG. 3.—Jigs and Feeder, Trommel and Drying Table, Nos. 20, 15, 19, 47.

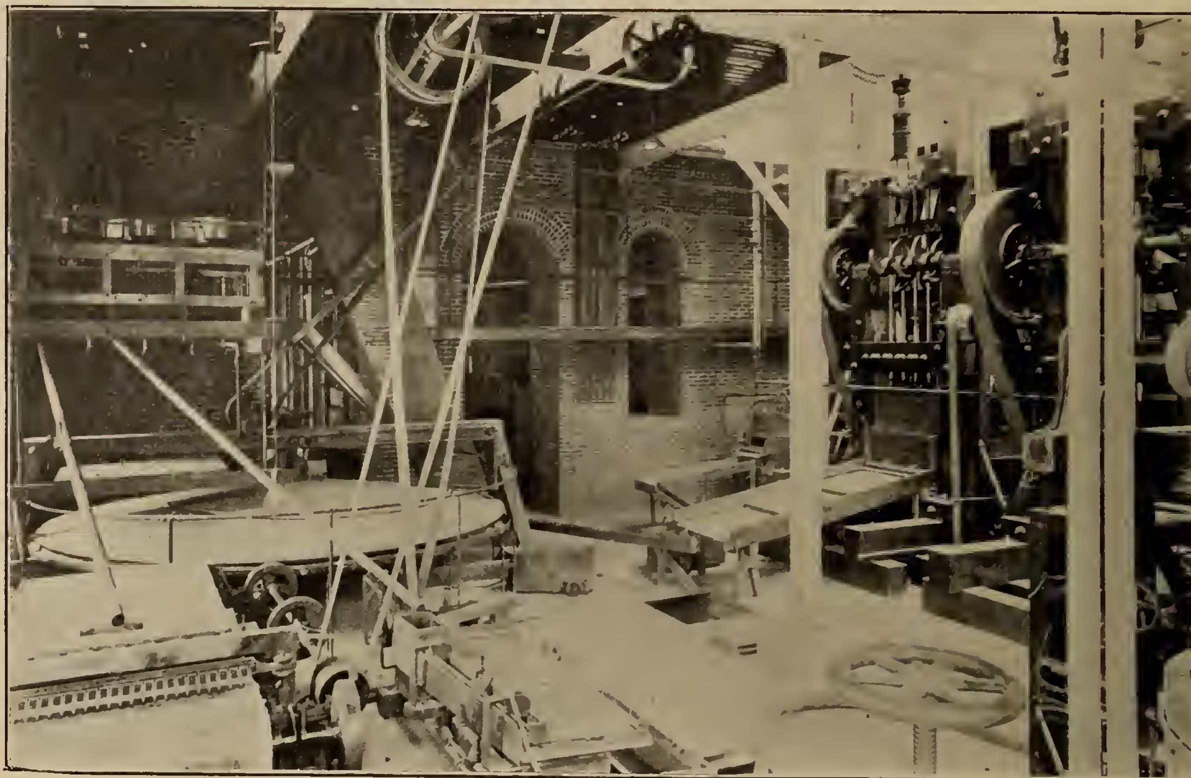

FIG. 4.—Batteries, Classifiers, and Tables, Nos. 8, 11, 37a, 25, 31, 36, 37.

FIG. 5a.—Bartlett Table and Slimer, Jigs and Classifiers, Nos. 32, 33, 21, 22, 26

FIG. 5b.—Stamp Batteries, Steam Stamp, Jigs and Rittinger Table, Nos. 8, 9, 10, 21.

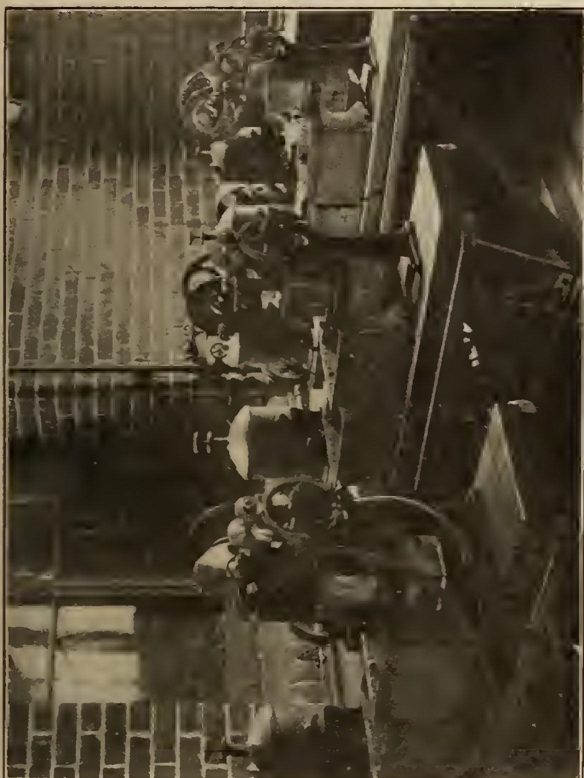

FIG. 6a.—Small Amalgam Pans and Vezin Jigs, Nos. 42, 23.

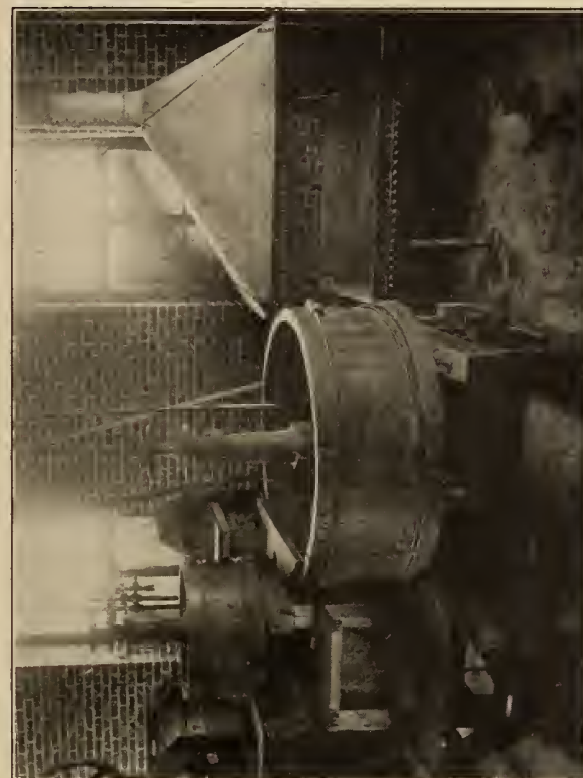

FIG. 6b.—Amalgam Pan, and Sett'er and Drying Table, Nos. 40, 41 and 48.

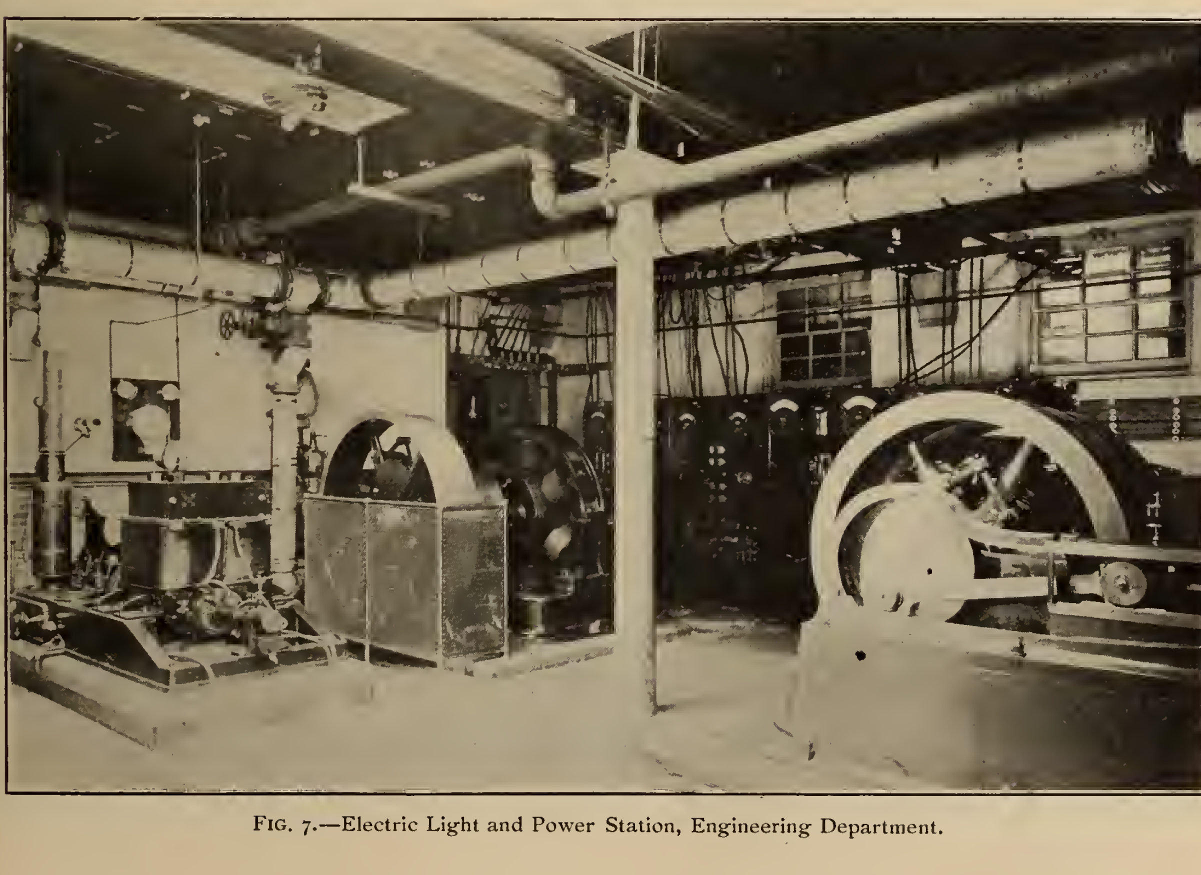

FIG. 7.—Electric Light and Power Station, Engineering Department.

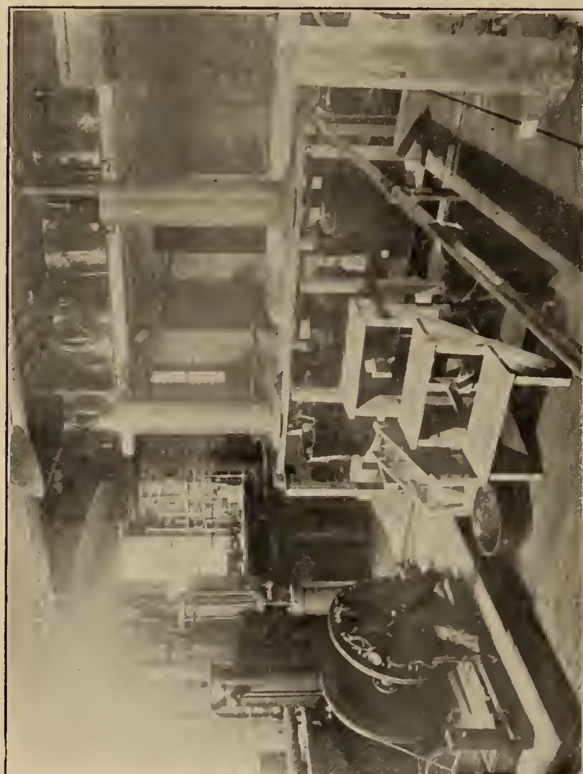

FIG. 8a.—Cyanide Plant, No. 49.

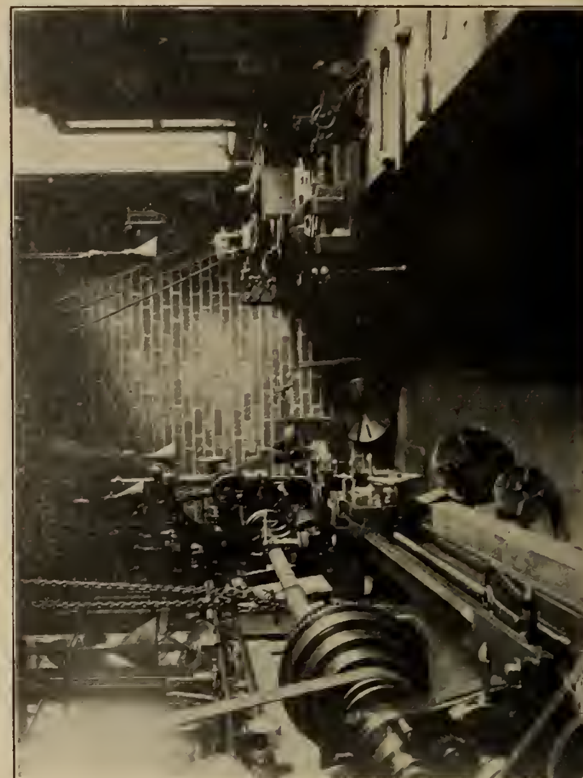

FIG. 8b.—Machine Shop, Mining Department.

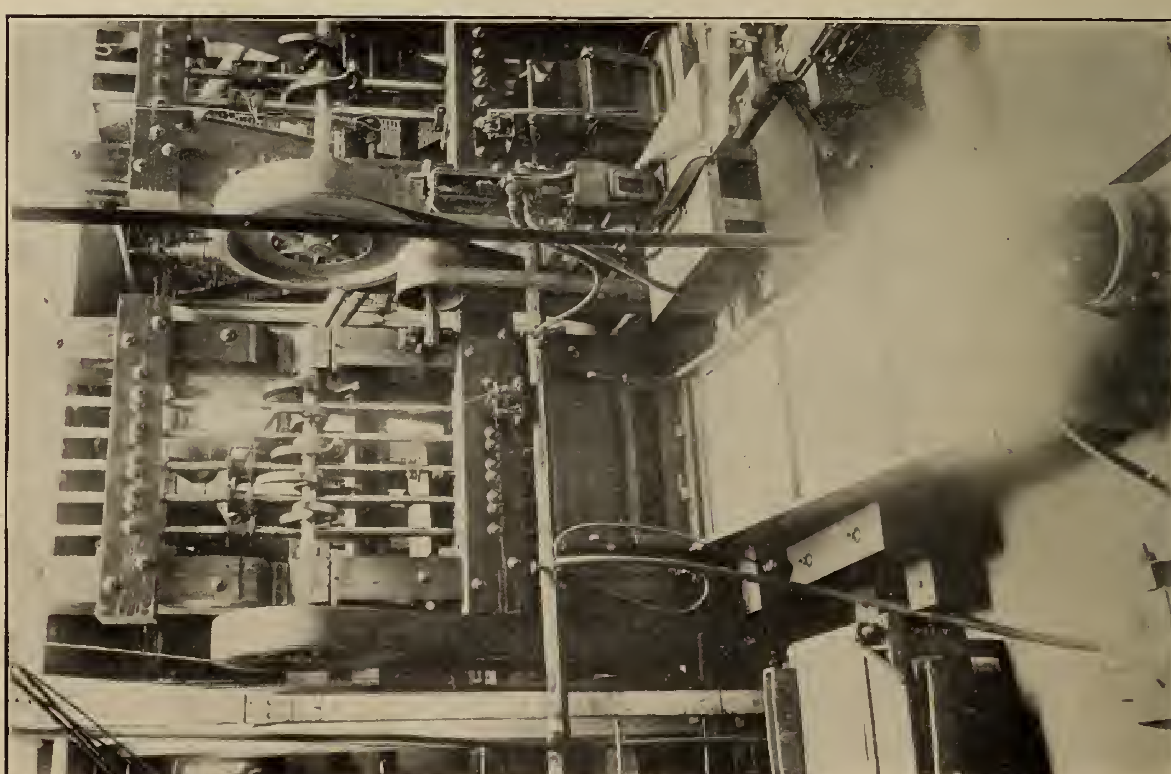

FIG. 9.—Stamp Batteries and Plates, Nos. 8, 9, 10, 37a.

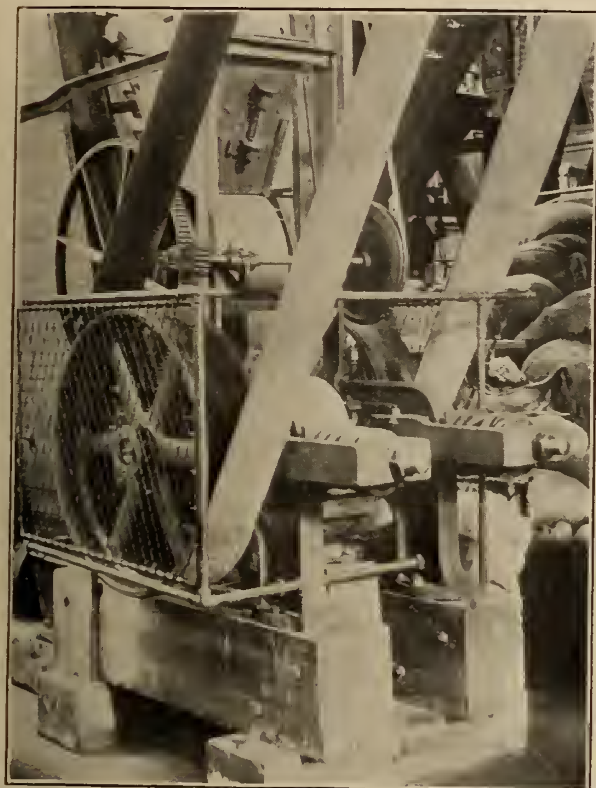

Fig. 10a.—Crushing Rolls, No. 12.

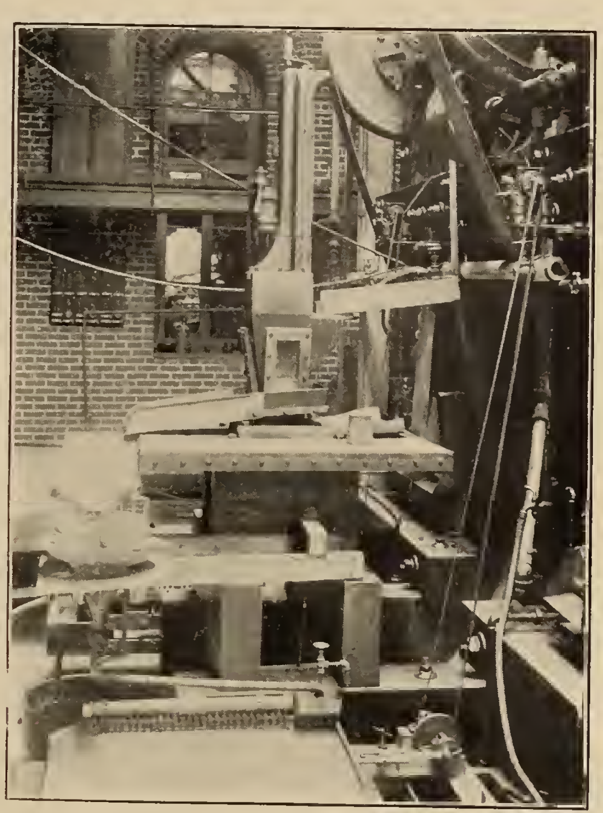

Fig. 10b.—Steam Stamp and Table, Nos. 10, 39, 27, 35.

Fig. 11a.—Classifier arranged as Washer for Fine Coal, No. 26.

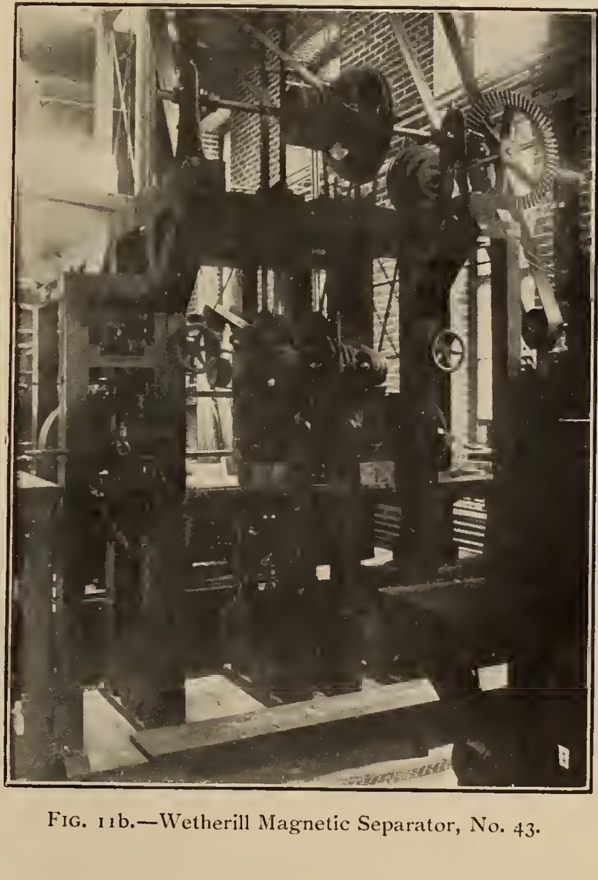

Fig. 11b.—Wetherill Magnetic Separator, No. 43.

KEY TO FLOOR PLAN OF McGILL MINING LABORATORIES.

Ore Dressing Dept.

1. Comet Crusher.
2. Dodge Crusher.
3. Ball Mill.
4. Sample Grinder.
5. Roller Jaw Crusher.
6. Hydraulic Lift.
7. Bridgman Sampler.
8. Five Stamp Battery, 600 lbs.
9. Two Stamp Battery, 1,000 lbs.
10. Steam Stamp .
11. Huntington Mill.
12. Crushing Rolls.
13. Suspended Challenge Feeder.
14. Challenge Feeder, Portable.
15. Tulloch Feeder, Portable.
16. Blake Crusher.
17. Shaking Screens.
18. Shaking Screens.
19. Trommel, with 3 fields.
20. Large Jig. 2 comp.
21. Large Jig, 4 comp.
22. Three small Jigs, 2 comp.
23. Three Vezin Jigs, 1 comp.
24. Spitzkasten, 4 comp.
25. Brown Sizer, 3 comp.
26. Three Large Cone Classifiers.
27. Three small Cone Classifiers.
28. Pointed Box Settler.
29. Three Brass Tube Classifiers.
30. Seven Glass Tube Classifiers.
31. Wilfley Table.
32. Bartlett Table.
33. Bartlett Slime Table.
34. Small Riffled Table.
35. Small Riffled Table.
36. Evans Buddle.
37. Frue Vanner.
37a. Battery Plates, Large.
38. Battery Plates, medium.
39. Battery Plates, small.
40. Amalgamation Pan, large.
41. Settler.
42. Six Amalgamation Pans, small.
43. Wetherill Magnetic Separator.
44. Heberli Magnetic Separator.
45. Centrifugal Separator.
46. Pneumatic Jig.
47. Steam Jacketed Drying Table.
48. Steam Jacketed Drying Table.
49. Cyanide Plant.
50. Elmore Plant.

Metallurgical Dept.

60. Brueckner Roaster.
61. Hand Roaster.
62. Blast Furnace, water jacketed.
63. Fore-hearth.
64. Cupellation Furnace.
65. Wind Furnace.
66. Forge.
67. Gas Muffle.
68. Gas Furnace Table.
69. Electric Furnace Table.
70. Chlorination Barrel.
71. Power Saw.
72. Grindstone.
73. Drop Test.
74. Electrolytic Table.
75. Power Lift.
76. Iron Table.
77. Polishing Apparatus.
78. Small Blower.
79. Experimental Open Hearth Furnace.
80. Recording Pyrometer.
81. Soft Coal Muffle.
82. Six Wind Furnaces.
83. Six Muffle Furnaces.
84. Three Gas Muffle Furnaces.
85. Draft Cupboard.
86. Seven Working Benches.
87. Bucking Board.
88. Bullion Rolls.
89. Root Blower.
90. Hydraulic Press.

Power, Etc.

100. 15-H.P. Motor.
101. 15-H.P. Motor.
102. 15-H.P. Motor.
103. 10-H.P. Motor.
104. 2-H.P. Motor.
105. 2-H.P. Motor.
106. 2-H.P. Motor.
107. 2-H.P. Motor.
108. 1-H.P. Motor.
109. 2-H.P. Motor.
110. Ventilation Fan.

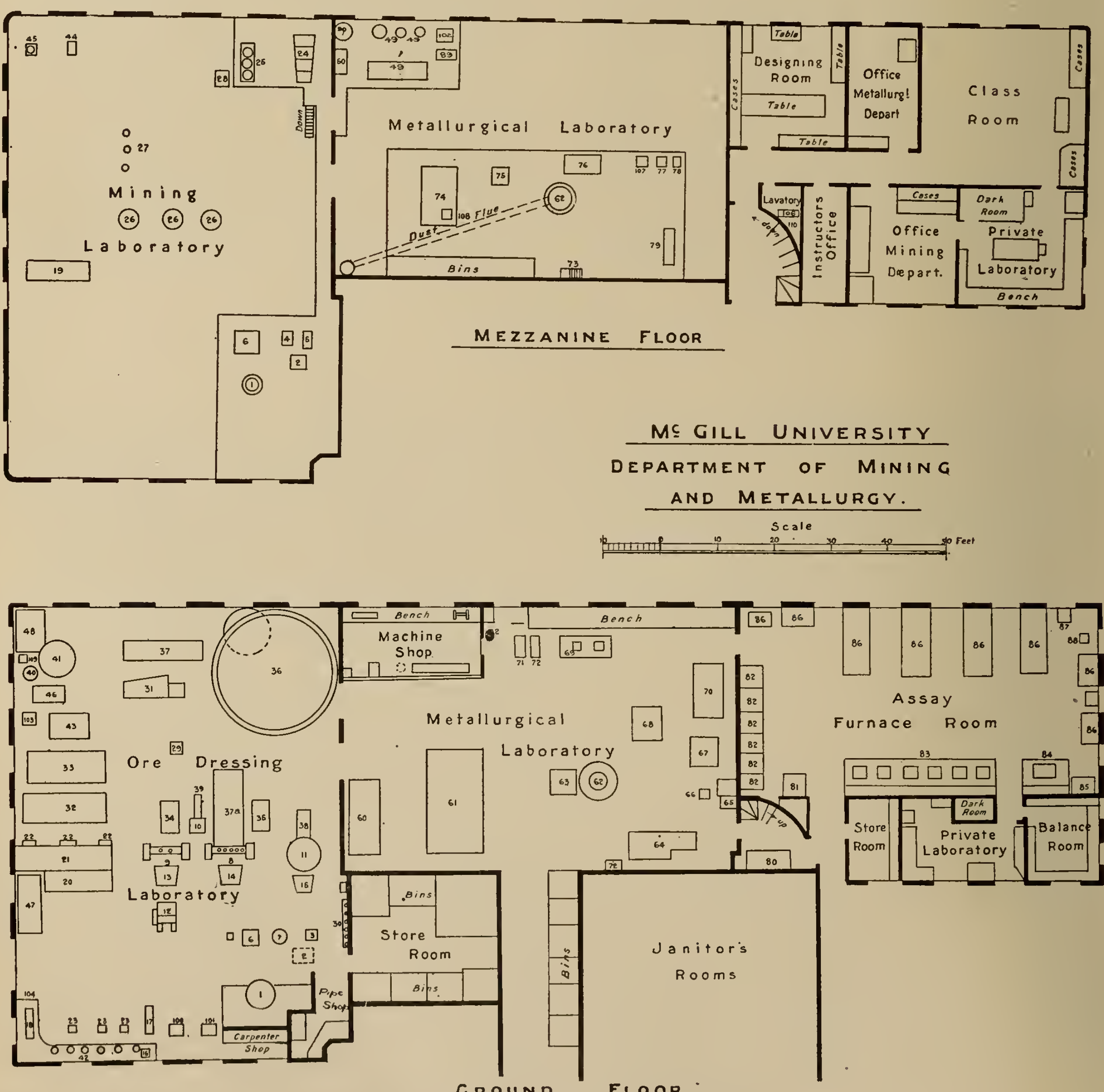

FIG. 12.—Floor Plans of Department of Mining and Metallurgy, McGill University.

THE TEACHING OF METALLURGY IN COLLEGE LABORATORIES, AND A DESCRIPTION OF THE EQUIPMENT AND USES OF THE METALLURGICAL LABORATORIES AT McGILL.

By Dr. A. Stansfield, Montreal,

In writing an account of the Metallurgical Laboratories of McGill University, it became evident that a broader subject, the teaching of Metallurgy in college laboratories, its uses and its limitations, should first be considered. A discussion of the subject accordingly forms the introduction to this paper.

Metallurgical laboratory teaching has not yet reached any standard pattern. The widest divergence of opinions exists with regard not only to the scope of such teaching but even as to whether any metallurgy worthy of the name can be taught at all in the college laboratory.

A recent paper by H. C. Jenkins,* on "The Equipment of laboratories for advanced teaching and research in the Mineral Industries", produced such a crop of discussion in the Institution of Mining and Metallurgy, in London, that it would be hard to find anything to add to what was said of written on that occasion.

Without raising the wider question, whether metallurgical laboratory teaching is worth doing at all, it will be advisable to indicate the uses of such laboratories in metallurgical teaching.

Students on this continent have very great facilities for obtaining practical experience in smelters and metallurgical works both during the annual summer schools that are held in connection with most of our mining schools, and by taking subordinate positions in such works during the long summer vacation. It is therefore unnecessary to attempt in the laboratory to instruct the student in the practical operations of roasting or smelting which he can learn so much more easily and perfectly in the smelter. There are however many parts of a metallurgist's education that can be more easily gained in the laboratory than at the smelter.

The metallurgical laboratories of a university have several distinct uses, all of which, however, should conduce to the education of the student, and these uses may be outlined as follows:—

1. *The use of furnaces and other appliances to illustrate the lectures.*—This is particularly useful in lecturing to junior students who have not yet visited metallurgical works.

For such students the laboratory furnaces, if on a reasonable large scale, tend to give concrete ideas of the real furnaces, and also enable some metallurgical principles, for example the principles involved in firing with hard or soft coal, coke, gas or oil to be presented vividly.

2. *The teaching of fire assaying.*—This, although forming a part of the teaching in metallurgical laboratories, will not be considered in this paper.

3. *The use of metallurgical measuring instruments.*—The pyrometer for measuring high temperatures, the calorimeter for measuring the calorific power of fuels, and the microscope for the examination of steel and other metals are all instruments whose use should be acquired by the metallurgical student.

4. *Properties of metals, fuels, and refractory materials.*—The more important mechanical, physical and chemical properties of the common metals, alloys, fuels, refractory materials and fluxes can be easily learnt with the aid of simple furnaces and appliances in the laboratory, and knowledge so gained is far more useful than if acquired from books.

5. *Study of metallurgical reactions.*—The reactions that are at the root of mnny metallurgical operations can be studied very perfectly in the laboratory, with the aid of simple and inexpensive appliances. Thus the roasting of an ore can be exactly studied, and the chemical changes that take place, and the temperature necessary for each stage of the process can be determined. Prof. Howe* shows how such work can be carried out by a class of students, but in many cases the object of such experiments would be to improve commercial practice in certain particulars, and should be taken as an advanced student's thesis or even as research work by a member of the teaching staff.

6. *Large furnace runs.*—In laboratories provided with large scale furnaces for roasting or smelting, it is usual to have occasional runs of such furnaces. The lecturer explains beforehand the particular problem that is to be met and the calculations necessary for making up a smelting charge. The students carry out as far as possible the operations during the run, and after the clean up, the result of the run is presented to the class and compared with the results predicted and with the results that would be obtained in actual practice.

When time permits, it is desirable that the students should themselves make the chemical analyses before and after the run, and the sampling of the materials composing the charge and of the products of the run affords valuable experience. The opportunity may also be taken to sample and analyse the furnace gases, determine the furnace temperatures, measure the amount of air entering the furnace, and the amount and rise of temperature of the jacket water in the case of a blast furnace campaign.

Taken in this way a small furnace run has an educational value quite apart from the practical experience gained by the student, and is not open to the criticism of being merely a bad imitation of works practice.

7. *Student's theses.*—One of the most important uses of metallurgical or ore dressing laboratories is or enabling advanced students to attempt to solve some definite problem in connection, for example, with the treatment of an ore. A large number of such problems can be worked out satisfactorily on quite a small scale, and then if time permits can be repeated on as large a scale as the laboratory affords, thus enabling the effect of scale to be quantitatively determined.

Work of this character tends to throw the students largely on their own resources, and affords extremely valuable training, teaching precise experimental methods, careful observation and correct reasoning from the results of experiments; it also encourages initiative in devising new methods.

8. *Use of laboratories by teaching staff.*—Apart from direct use by the students, the laboratories are useful to the staff; their use tends to prevent the teaching becoming too academic in character. Each member of the staff should have some research, either on theoretical or practical lines. Outside testing or experimental work should be undertaken to keep the staff in touch with technical and commercial requirements.

*Trans. Inst. Mining and Metallurgy, London, Vol. XIII.

*H. M. Howe, "Metallurgical Laboratory Notes." In the introduction to this work he discusses the teaching of metallurgy, and insists that principles rather than practice should be taught in the College laboratory.

Any information directly gained in this way is far more valuable than that obtained at second hand or from books.

Having outlined some of the uses of a metallurgical laboratory one can the better consider the actual equipment and how far it comes up to the requirements already outlined.

The laboratories at McGill consist of a furnace room 60 ft. by 38 ft. and 18 ft. high, a smaller room for fire assaying 54 ft. by 24 ft. and smaller rooms for balances, chemical and photographic work, microscopy and pyrometry.

GENERAL SUMMARY OF EQUIPMENT.

The main laboratory contains a water jacket blast furnace with interchangeable crucibles for smelting either lead or copper ores, a reverberatory roasting furnace, a Bruckner roaster, a cupellation furnace, and a chlorination barrel.

These appliances are on a relatively large scale, and will be described later in detail.

There is also a large, 17 inch, crucible furnace provided with forced draft, a large gas muffle furnace or forge, a brick topped table with gas and air connections for experimental gas furnace work, another brick topped table equipped for electric furnace work. A table with terminals for low voltage current for electrolytic experiments and a model open hearth regenerative gas furnace.

The fire assaying room contains a number of wind furnaces and muffle furnaces for coke, soft coal, oil and gas which will not be considered in the present paper.

The several furnaces may now be considered in detail with the uses to which they can be put.

Bruckner roasting furnace.—The rotating drum has an external diameter of 2 ft. 8 inches, and a length of 5 feet, and is lined with 4½ inches of fire brick. It is fired by means of soft coal or wood in a movable firebox. The charge of ore used is about 250 lbs.

Reverberatory roasting furnace.—A view of this is given in Fig. 7b. The hearth measures 6 ft. by 14 ft. internally, and will take about 1,500 lbs. of ore.

There are three working doors on each side of the furnace. The flue descends at the end of the furnace and returns beneath the hearth constituting a dust chamber.

The fire box was originally 4 ft. by 2 ft., but the consumption of coal has been greatly reduced and the efficiency of the furnace increased by reducing the fire box to 3 ft. by 1½ ft. and introducing a steam jet forced blast into the closed ash pit, thus turning the fire box into a gas producer.

The chemical and physical changes that take place during the roasting of powdered ore can be studied quite as well if not better in a small gas fired muffle furnace, but the reverberatory furnace affords approximate information with regard to the roasting of any particular ore on the large scale, and has much educational value in regard to the economical firing of such furnaces. One of the difficulties connected with the use of large reverberatory furnaces in the laboratory is the great length of time that must elapse before the furnace has become thoroughly heated.

A large roasting furnace is sometimes necessary in order to roast quantities of ore for subsequent smelting operations.

The stall or kiln roasting of lump ores of copper has been successfully carried out on a small scale in one of the wind furnaces.

Water jacket blast furnace.—This is circular, having an internal diameter of 21 inches at the tuyeres, and 33 inches at the top of the jacket. The height from tuyeres to charging door is 7 ft.

There are 3 tuyeres of 2½ inches diameter, and the furnace is blown by a No. ½ Root's blower driven by a 15-h. p. electric motor.

There are two crucibles both on wheels, the one for lead smelting containing a large well with the usual siphon tap for the lead, and spout for the slag. The copper crucible is much shallower, and originally the matte and slag were tapped periodically into slag pots where the matte settled by gravity and was separated from the slag when cold. The slag obtained in this way was never very clean, and experiments were made first with an internal crucible, tapping the slag and matte off at different levels; and finally by adding a fore-hearth in which the matte settled from the slag. The fore-hearth is 34″ by 25″ by 19″ high externally, and is lined with ½″ asbestos, 2½″ of fire brick and 2″ of brasque and covered with 3″ fire clay tiles, as it was feared that a fore-hearth with so small a flow of slag and matte would be apt to freeze up. To further prevent loss of heat, the usual spout between furnace and fore-hearth is omitted, and the molten charge allowed to enter the fore-hearth through a covered channel below the level of the slag in the fore-hearth. It is in fact the Herreshoff fore-hearth, but without any water cooling.

As a further precaution a gas blowpipe is arranged so that a flame could be introduced between the surface of the slag and the tile cover if any signs of freezing are observed.

A granulating apparatus is arranged to deal with the slag and works satisfactorily. The general arrangement is shown in Figs. 3 and 4. The slag from the fore-hearth is very much cleaner than has previously been obtained.

The blast furnace can easily be blown in, run for two or three hours, and blown out during the student's working day, the crucible and fore-hearth having been heated up previously; but the work of cleaning up and preparing for the next run is very considerable.

During the run, in addition to weighing and charging the ore, fluxes and coke and to manipulating the molten slag and matte, the students are required to determine the volume and temperature of the jacket water, the speed of the blower, pressure of blast, condition of furnace at the tuyeres, and on top of the charge, rate of flow of slag, and of granulating water, etc., and the data so obtained are worked up and form the subject matter of a subsequent lecture after the necessary analyses have been made.

Having obtained satisfactory slag settling facilities, the next problem to be attacked was that of pyritic smelting, and the first experiment made in that direction met with a reasonable degree of success, the slag and matte analyses agreeing very closely with the predicted values and interesting information was obtained from the gas analyses.

The author considers that these furnace runs very greatly increase the value of the lectures on this branch of the subject.

In running a blast furnace, even so small as the one at McGill, it is noticeable that the students are apt to be occupied by the actual operations of weighing, charging, tapping, etc., to such an extent that they are likely to lose the educational value of many of the phenomena to be observed. As it is not intended to train the students as expert weighers, chargers or tappers this preoccupation with the actual operation is apt to detract from the educational value of the run, and as far as the investigation of the principles of smelting goes a furnace on even smaller lines would answer every purpose, and would have the additional advantages that less ore and fuel would be needed, that the students could be left more entirely to their own devices in running the furnace, and that they would be able unaided to clean up the products of the run and make out balance sheets.

The author has on two occasions built and operated with students small brick furnaces 9″ sq. inside, and has smelted in each a few hundred pounds of copper ores without serious difficulty. As so small a furnace would inevitably freeze up if it were attempted to tap the products. A small fore-hearth was added and the molten products were kept hot by a flame issuing from the crucible of the furnace.

Working on a small scale, it is usually impossible in furnace work to imitate both the arrangements and the results of large scale operations. One may build and operate a model furnace, but it will not usually give normal results. To obtain good conditions, it is usually necessary to depart widely from the adopted type of furnace—such changes being due mainly to the very much greater loss of h at that occurs on the small scale.

In metallurgical laboratory teaching, when this alternative offers, the author would not recommend in general that the works pattern should be followed, but that an entirely new furnace should be designed that will enable the principles to be experimented with and demonstrated, and have perhaps a few large scale appliances that can be at once models and working furnaces.

English Cupellation furnaces.—This furnace was originally installed as the smallest furnace that could be obtained ready made that would serve as a reverberatory smelting furnace. It is obvious that a metallurgical laboratory would not often have enough argentiferous lead to need the use of a 48″ by 30″ test. The furnace has been used for smelting lead ores and it is intended to remodel it with a view to the regular smelting of either lead or copper ores. In this, as in the roaster furnace, a steam jet forced draft has been added with great advantage.

Crucible furnace.—A crucible furnace 17″ sq. has been provided with forced blast, and it is easy in this furnace to melt steel in crucibles or to test the fusibility of refractory materials.

The blast for the blast furnace and for the crucible furnace is furnished by a No. ½ Root's blower driven by 15 h.p. motor. For small gas furnace work a 1 h.p. blower giving up to 1 lb. pressure has been added to avoid running the large blower and motor.

Gas furnaces.—For metallurgical teaching and research purposes, the ordinary city gas affords an ideal heating agent for many purposes, and as Prof. Howe very clearly points out, it is better in general to use a fuel that will afford constant, easily regulated and definite conditions of temperature and of atmosphere in which to study definite metallurgical problems, than to introduce at the same time the difficulties connected with the use of coal or other solid fuel.

A 1 h.p. high pressure blower has recently been installed and piped to different parts of the laboratory and with the aid of some home made blow pipes of various sizes and a few fire bricks it is easy to construct small furnaces as occasion arises.

A brick topped table (Figure 3) provided with a hood and connections for gas and air is specially convenient for this class of work, while a combined forge and muffle furnace obtained from the American Gas Furnace Company has proved very convenient for roasting small quantities of ore, for fire assaying and for researches in which a number of bars of steel were heated nearly to their melting temperature in order to ascertain the conditions under which steel became "burnt" and the true nature of the so-called burning.

Those who have designed model furnaces may be interested to hear of a model open hearth furnace constructed at McGill. It was built as a model on the 1 inch to the foot scale of a 50 ton tilting open hearth furnace, with the exception that coal gas was used and that chequers were provided only for the air. Without going into detail, it may be said that using an amount of gas proportionately, about equal in heat value to that used in the large furnace, the chequers did not have nearly the effect that was expected, and it was found that on account of the relatively larger area of the walls of the small scale furnace, and the actually smaller thickness of the walls the loss of heat was so great that the chequers never became thoroughly heated.

Using a larger supply of gas the supply of preheated air was inadequate to burn it, and it became obvious that for small scale gas furnaces the gas blow pipe with air preferably preheated in a pipe stove was decidedly more efficient, and that in order to exhibit the effect of chequers in preheating air the furnace would have to be built larger, using producer gas, or else the most extreme care should be taken to avoid loss of heat by the use of thick walls containing very poorly conducted layers, such as asbestos pulp.

It is intended to construct a small gas producer with a view to illustrate details in the production and uses of gaseous fuel.

Electric furnaces.—A brick topped table (Fig. 2) has recently been constructed to which not only the electric current but also gas, air and water has been led. The gas and air being intended as a substitute for the more costly electric power for the drying and preliminary heating of certain of the electric furnaces; while water is sometimes needed for cooling the terminals and metal casings of furnaces.

Many varieties of electric furnace have been experimented with, but owing to the relatively high voltage and low current available, the arc furnaces have heen more generally useful. The horizontal arc furnace of Moissan has been found especially useful in melting metals for demonstrational purposes. The vertical arc furnace is also useful for melting metals and for reducing metals from their ores. The production of calcium carbide in this form of furnace has been found to be a suitable exercise for class purposes.

For the electrical smelting of ores, furnaces of the Heroult type have been used in which two vertical carbons dip into the furnace and arcs are formed between these and the charge. Resistance furnaces are more satisfactory for many purposes than arc furnaces, but the necessity of using current at 110 volts renders small resistance furnaces exceedingly wasteful of power.

The power available for electric furnace work is about 200 amperes of direct current at 110 volts, and while this is sufficient to exhibit the principles of electric heating and to enable many experimental points to be determined, it is inadequate for carrying out electric smelting even on the smallest satisfactory scale, especially when low resistance furnaces have to be used. It is hoped that a sufficient supply of alternating current at 110 volts and a transformer for reducing to lower voltages will be provided to enable some of the newer processes to be worked out on a scale that would afford information to intending manufacturers, and training for students who wish to specialize in electro-metallurgy.

Microscopy.—The outfit consists of cutting and polishing machinery for preparing the specimens of steel or alloy, a special microscope for examining the specimens and a long photographic camera for recording the microscopic structures so revealed.

Pyrometry.—A thermo-electric pyrometer is usually employed for measuring temperatures in the laboratory. This is connected to a galvanometer which indicates the temperature, and a photographic apparatus enables continuous records of temperature to be obtained. Several pyrometers of the Callendar type are also available for use.

Calorimetry.—A Mahler bomb calorimeter is used for determining the calorific power of fuel.

Analytical work and fire assaying.—The students are expected to have attained to a reasonable degree of proficiency in these subjects before commencing their final year's work, and the laboratory work in that year is so arrainged as to involve some quantitative chemistry and fire assaying, thus enabling the students to make use of the knowledge they have gained in these methods. The necessity for a reasonable degree of speed and reliability in their work is impressed upon them in this way, and they become more ready to carry out such work at short notice.

Electrolysis.—A table has been fitted up for electrolytic work, being provided with a 1 h.p. 10 volt dynamo driven by a 1 h.p. motor, a small storage battery has been added to enable experiments to be left running over night.

Within the limits of this paper it has been impossible to do more than hint at most of the experiments that have been made or can easily be carried out in these laboratories; the limiting consideration is usually the short time at the disposal of the student rather than any limitations of the laboratory. Nevertheless the author is only too painfully aware of deficiencies in the equipment, and endeavors as time and money will permit to raise the standard both of the laboratories and the work that is done in them.

Fig. 1.—Macdonald Chemistry and Mining Building, McGill University.

FIG. 2.—Electric Furnaces, No. 69.

FIG. 3.—Gas Table, Gas Muffle and Chlorination Barrel, Nos. 67, 68 and 70.

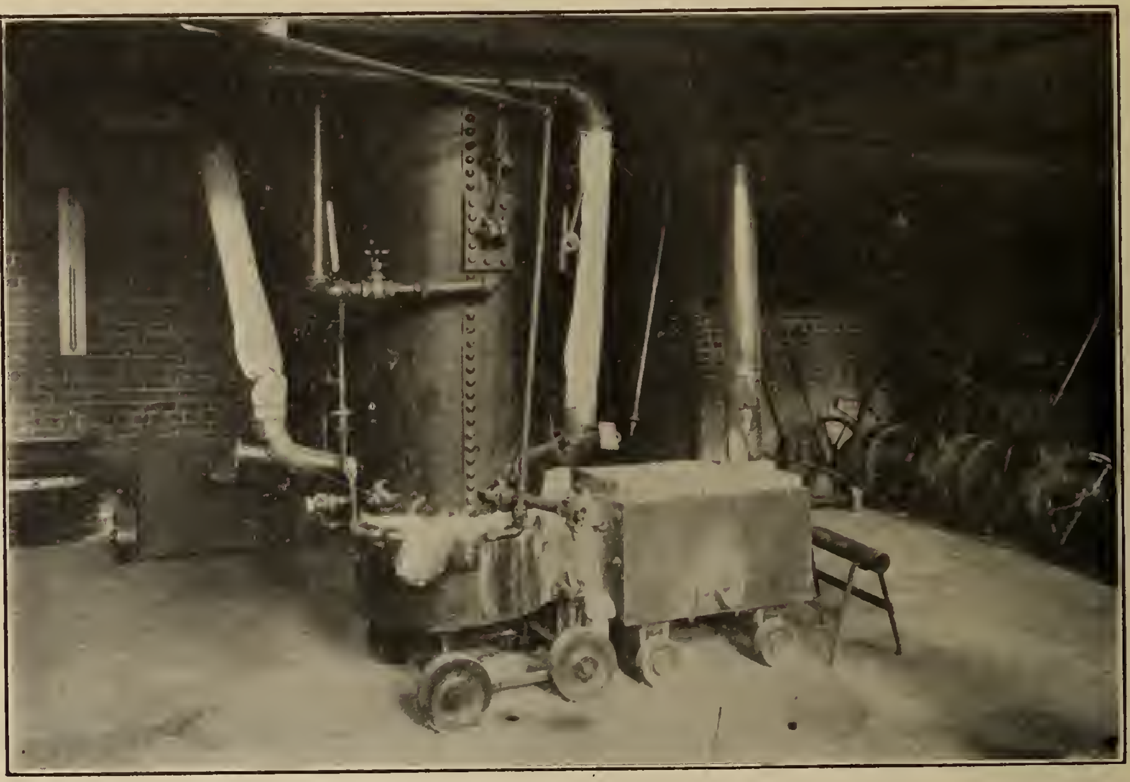

Fig. 4.—Water Jacket Blast Furnace and Fore Hearth, Nos. 62 and 63.

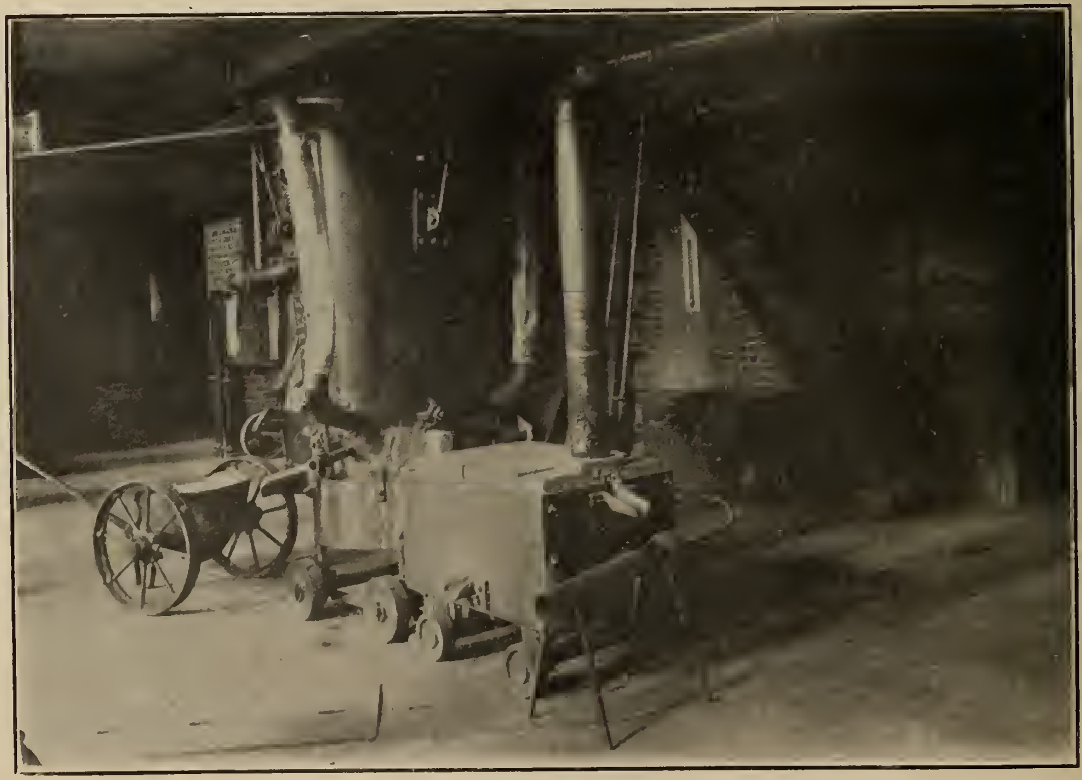

Fig. 5.—Water Jacket Blast Furnace and Fore Hearth, Nos. 62, 63.

FIG. 6.—Cupellation Furnace, No. 64.

FIG. 7a.—Experimental Open Hearth Furnace, No. 79.

FIG. 7b.—Hand Reverberatory Roaster, No. 61.

MR. N. D. DARU.

Mr. Nanabhai Dayabhai Daru, B. Sc., B. A., of Bombay, B. Sc. in engineering and metallurgy, London, an Associate of the Royal School of Mines and Barrister at Law, is at present in Ottawa, being an attaché of the Indian Government to the Geological

Survey of Canada. Mr. Daru is a native of Daru-Falia Surat, India, and has been sent to Canada by the Indian Government to stúdy the methods employed in mining in this country. He is under ins-instructions to make a thorough of this subject, and to remain in the Dominion for two years, during which time he will visit the principal mining centres. Mr. Daru has already made many friends in Canada, especially among the mining fraternity.

ECONOMICAL COAL MINING.

One of the most successful and interesting electric coal mining equipments is found at the Tropic Mining Company's mine located on the Zanesville & Western R.R. at Deaverton, Morgan County, Ohio. The Tropic Mining Co., here operate in the No. 6 seam, which has an average thickness of 3′—8″ the coal being of very excellent quality, and is known on the market as the "Celebrated Tropic Coal."

The average daily output of the mine is about 1,400 tons run of mine coal in 8 hours. In order to reduce the cost of mining and decrease the percentage of "slack", nearly all the mining is done by chain machines. The Tropic Mining Co., have installed an electric plant which furnishes power to the mining machine, electric locomotive and stationary motors. The power plant consists of two 100 K.W.-250 volt direct current, belted generators, built by the Jeffrey Mfg. Co., of Columbus, Ohio, each generator being driven by a 16″ x 6″ McEwen Engine. The switchboard is of the skeleton type and equipped with necessary instruments and switches for controlling the dynamos. Steam is supplied by a battery of two 72″ x 18′ Atlas boilers equipped with the necessary apparatus for supplying feed water to the boilers. In the power house is also installed a double reversible 10″ x 12″ hoisting engine with two 3′ 6″ drums, which furnishes power for the rope haulage installed for handling the cars on the slope. The length of the rope haulage is about 1,200 feet the maximum grade being 15 per cent. Twenty cars is the average number hauled per trip, the empty cars being returned down the slope by gravity. The entries are driven 16 feet wide with an average height of 4′ 6″. The rooms are driven to a depth of 250 feet and a width of 30 feet the room necks being 12 feet wide. There is at present installed 9 electric undercutting mining machines of the chain type. Eight of the machines were furnished by the Jeffrey Mfg. Co., of Columbus, Ohio, and are of their well known Class 17-A. machines, making an undercut of 6 feet in depth and 41 inches in width. The average number of runs per day of eight hours in 40 runs and the maximum runs each machine is sixty. The mining machines are equipped with self-propelling arrangement by which they can readily be moved from one point in the mine to another without delays.

On account of the thin vein 3′ 8″ only very small mules or ponies can be used for gathering the cars from the face workings. The weight of the mules employed is between 500 and 600 lbs., the maximum height of the mules being 52″. The coal is gathered to four different partings by 14 mules and 14 drivers, each mule with driver gathering on an average of about 120 cars per day. This includes coal, slate and other materials which are taken out of the mine.

Each driver takes care of about 14 rooms and at present the average length of the mule haulage is 900 feet. To haul the mine cars from the partings to the bottom of the slope, a six ton Jeffrey standard type electric locomotive is employed. The locomotive averages about 60 trips per day of eight hours and handles between 1,200 to 1,350 cars per day. The average length of haul from the four partings is about 1,200 feet, there being but very slight grades against the "loads" the maximum being about 2 per cent. and this only for a short distance.

The locomotive haulage is laid with 30-lbs. steel rails, but in the rooms the weight of the rails is 16 lbs. per yard. The locomotive when delivering the loaded cars to the bottom of the slope has to make a "flying switch" for a side track, and as portion of the track on which the loaded cars are delivered is on a grade, it is necessary for the locomotive to pass over the switch at full speed in order to give the loaded trip enough momentum to clear the switch at the side track. The trip rider uncouples the cars and the switch is thrown automatically by the locomotive as it passes. The locomotive handles from 18 to 30 cars per trip the weight of loaded cars being 3,900 lbs.

The tipple designed for an output of 2,000 tons of coal per day, is equipped with an automatic Phillips cross over dump, which readily handles the output of the mine. The blacksmith shop is equipped with a four horse power stationary motor which furnishes power to drive the blowers for the forges and other shop tools.

All apparatus at the mine is handled on an efficient and systematic schedule which makes possible a maximum output at a minimum cost of production. The Tropic Mining Co., of which Mr. George M. Jones is President has its main offices located at Toledo, Ohio, the mine being in charge of Mr. J. D. Jones, General Manager of the Company.

THE ASHLAND EMERY AND CORUNDRUM OCMPANY.

This company is now operating the Burgess corundum in the town of Carlow, Ont. and, it is reported with manifest success. The plant consists of a mill 110 by 60 feet. There are six concentrators, in which the crushed material is treated. the iron being eliminated by means of a revolving magnet. The Wilfley tables of the latest pattern are used, the system of dry concentration being practically the same as used in gold reduction mills. The company have ordered $20,000.00 worth of additional machinery from England, which is about to be installed. The power is furnished by a 70 h.p. engine, with two 70 h.p. boilers. Thirty-five men are employed. The company owns the water power at Little Carlow, from which electric power can be developed.

LE ROI DIVIDENDS.

On Feb. 28th, the shareholders of the Le Roi Mining Company received a dividend for the first time since November, 1899. The amount paid to date by this mine, exclusive of the last dividend, was $1,305,000. With this last payment of $75,-000.00 added the total distribution for the present company now amounts to $1,380,000.00.

The Le Roi Two is now engaged in extracting ore from what is the longest ore shoot that has yet been located here, 1,200 feet, with a width of from three to three and a half feet, and, what is more important, the ore carried by the ledge is of a high grade. Besides this, there has been found on the 1,350-foot level of the Le Roi Two a good shoot of ore of a shipping grade, which is 750 feet below the point where the long and rich shoot is located.

ATIKOKAN IRON MINES.

A spur line is being built at the Canadian Northern Railway from its main line to the Atikokan Iron Mine, 135 miles west of Port Arthur. It is expected to be ready for operation within the month.

THE MINING SHARE MARKET.

Specially reported for the CANADIAN MINING REVIEW, by Robert Meredith & Co., Mining Brokers, 57 St. Francois Xavier Street, Montreal.

Since we last reported a great change has taken place in the market for mining shares. The activity throughout British Columbia has drawn public attention to the shares of companies in that district, and the reports from Cobalt, have inaugurated a regular little boom, causing the floatation of several companies, the stocks of which are selling at a premium before their actual value has been determined.

There is abundant evidence that this year is going to see great activity in mining, throughout Northern Ontario, and British Columbia. In the latter province, even now, the smelters are all running, plans are out for increased capacity, and the output of ore is daily increasing.

Mining is being carried on, on practical business methods, already some companies are on a dividend paying basis, and the prospects are that others will join them.

For some time past, there has been persistent buying of all the loose stock in the market, and now it is impossible to pick up any large blocks of stock at anything like quoted prices. The few small amounts offering are gradually being taken up, but as there is nothing like a boom, and the situation is perfectly healthy, there is every reason to expect an advance not only in the good dividend paying stocks, but also in many of the long forgotten, low priced, low grade properties.

The latest quotations are as follows:—

	Bid.	Asked.
Can. Consolidated Mines	135.00	138.00
Centre Star	.45	.46
Can. Gold Fields	.07¼	.07½
Granby Consolidated	.13	.13¼
St. Eugene	.90	—
Rambler Cariboo	.39	.40
North Star	.03½	.06
Monte Christo	.02¼	.03
White Bear	.02	.03
California	.02	.02½
Virginia	.02	.05
Deer Trail	.02¼	.03
International Coal	.35	.36
Sullivan	03	.04
Jumbo	.29	.30
Roselle	.24	.25
Cariboo-McKinney	.01½	.02
Dominion Coal (common)	.78	.80
Dominion Coal (preferred)	120.00	122.00
Dominion Iron and Steel (common)	.33½	.34
Dominion Iron and Steel (preferred)	.81¾	.82
Intercolonial Coal (common)	.80	.86
Intercolonial Coal (preferred)	.98	100.00
Nova Scotia Steel and Coal	.63	.64
Nova Scotia Steel and Coal (preferred)	118.00	120.00

COURT DECISIONS.

DECISIONS IN IMPORTANT PATENT CASES.

A number of decisions have recently been rendered by various courts throughout the country bearing upon various branches of the electrical industry and of more than usual interest.

In the United States Circuit Court of Appeals for the Third Judicial Circuit in Philadelphia a decision was handed down in an appeal from the Circuit Court for the Eastern District of Pennsylvania in the case of the Westinghouse Electric & Mfg. Company against the Cutter Mfg. Company. This suit involves an infringement of the Wright & Aalberg patent on automatic circuit breakers of the edgewise shunt carbon type in which the shunt carbons are at the top of the device and the movable contacts are carried by a long swinging arm equipped with toggle mechanism for giving it a wide throw in opening the circuit. This general type of circuit breaker has been regarded as the most practical device for interrupting circuits carrying heavy current exclusive of the oil break or magnetic blowout circuit breakers. The Court in its decision enjoined the Cutter Company from the manufacture of circuit breakers which come within the claims of the Wright & Aalberg patent.

In the United States Circuit Court for the Southern District of Ohio, the Court sitting at Cincinnati, the case of the General Electric Company against the Bullock Electric Mfg. Company was decided in favor of the former. This suit involved the Reist patent on the manufacture and sale of armatures for dynamo-electric machines ventilated by having certain forms of space-blocks inserted between the different groups of laminæ forming the core or magnetic circuit of said armatures. His Honor Judge Thompson in his decision restrained the Bullock Company from infringing upon the patent in question. The court held that two forms of ventilators being involved in this suit both were infringements. The result of this decision as construed by the court established the fact that all forms of ventilated armatures now in practical commercial use came within the terms of this patent. Its importance therefore is at once apparent.

In the case of the Westinghouse Electric & Mfg. Company against the Diamond Meter Company, of Chicago, an interlocutory decree was filed by His Honor Judge Humphrey in the United States Circuit Court for the Southern District of Illinois, sitting at Peoria. In this decree the Diamond Meter Company is permanently enjoined from manufacturing, using, or selling induction wattmeters under the Tesla Patents Nos. 511559 and 511560.

In the United States Court at Cleveland, Ohio, His Honor Judge Tayler recently enjoined the Milloy Electric Company from making, selling or using trolley stands or Milloy trolley bases. This suit involves a charge of infringement of the Van Depoele reissue trolley patent No. 11,872 of the Thomson Houston Electric Company. The Thomson Houston Electric Company recently entered suit against the Holland Trolley Supplies Mfg. Company, of Cleveland, Ohio, for infringement of the Van Depoele trolley stands. The United States Circuit Court for the Northern District of Ohio and Judge Tayler in his decision enjoined the Holland Company from making, selling or using trolley stands or Holland trolley bases.

Lasell v. Hannah, an appeal from the Supreme Court of British Columbia, was taken up in the Supreme Court of Canada. The appellant bought the action claiming from respondent 12,500 shares of stock in the Thistle Gold Co., and to restrain the winding up of the Sutherland Gold Mining Co. The questions in dispute arose out of an alleged agreement in respect to operating certain gold mining locations in the Cariboo district, British Columbia. At the trial Mr. Justice Martin dismissed the action as regards the Thistle Gold Company, and condemned the defendant Hannah to hand over the shares to Lasell, or alternatively for $12,500 with costs. This decision was reversed by the judgment appealed from on the ground that the agreement amounted to a conspiracy to deprive other shareholders in the gold mining company of their interests. Hon. C. Wilson, Attorney-General for British Columbia, for the Appellant, Ewart, K.C. and Morphy for respondent. Judgment was reserved.

COBALT NEWS.

A uniform report states that metallic gold has been found in the diabase near the head of Cross Lake. While this is news to a majority, it is a fact that metallic gold is occasionally found in the ore of the Drummond Mines, Ltd., and has also been found on the Buffalo property, and again to the north of Clear Lake.

A diamond drill to test what is at the bottom of Cobalt lake arrived at Cobalt recently and will shortly be put in commission. Where the drill will work there is some forty feet of water.

The enterprising citizens of Cobalt are mooting the building of a trolley line to connect the towns of New Liskeard, Haileybury and Cobalt.

Quite a lot of machinery has been sent into Cobalt during the last six months, and orders have been placed quite recently for new plants to go to the Ker Lake property, and to the property now being developed by Messrs. Rothschild and others. It is understood that both of these orders went to the Canadian Rand Drill Company.

Reports of the finding of gold between Sassaginaga Lake and Clear Lake are numerous, and it is believed that a valuable gold discovery has been made there.

The rubbish that is being talked and written about a market for Cobalt, and the ores of the Cobalt camp does not create any excitement in the town. The men who have been selling ore know too well the difficulties which are attached to their ore to believe that any cheap and simple process will speedily be found.

The Silver Lead Mining Company has sold its property to an American Company for $210,000.00 after spending in developing and prospecting only some $4,000.00. The property is situated near Ker Lake.

The Chief of Police at Cobalt states that theft is a thing unknown in the district. Prospectors can leave their tools on a claim for weeks and go back and find them safe; the same way in the town. The mines are shut down on Sunday, and the day is well observed. However, it is understood that the Government has decided to take precautionary measures for the enforcement of law and order in Cobalt in view of the anticipated rush to the district this spring.

Prospectors are strongly of the opinion that a mining inspector should be stationed at Cobalt, in view of the importance of the camp. Many lots are frequently awaiting inspection. The local press is bringing the matter to the attention of the public, and of the Government, and also of the Minister of Lands and Mines.

Development work is progressing very extensively southwest of Cobalt. Finds of all kinds are made or reported daily, but prospectors naturally do not talk about what they have until the prospector has passed their claim.

A new company has been formed in Haileybury, to be known as the Silver Lake Mining Company. They have several lots in Coleman and Bucke, which they will develop at an early date.

Numerous fake companies are reported to be operating on the basis of properties in Cobalt. Some of these properties are not for sale. Some of the companies have no property, or if they have it is not within the mineral belt. One advertisement announces that there is a vein of calcite on the promoter's property. Probably the statement is true, but it is apparently intended to deceive the ignorant, who are not aware of the nature of calcite.

It is generally expected that by October next the Government will open five square miles of the Gillies timber limit to prospectors. In anticipation of this the firm are now putting a camp on that part of the limit from which prospectors are excluded, and by the opening of spring it is thought the greater part of the timber will have been cut and shipped.

A report from Cobalt says: A stock exchange will soon be one of the institutions here, a charter has been applied for and is expected any day, a site for the building has been secured for $8,000, and a commodious structure will be at once erected pending the erection of the permanent exchange. The building has been secured where business will be carried on temporarily. It will be open call, and nothing but the best properties listed, wild cats will be carefully excluded. The prices for seats are fixed for the present at $50.

MINING INCORPORATIONS.

ONTARIO.

North American Cobalt Refining Company, Limited.—Capital $1,000,000.00, in shares of $1.00 each. Head Office, Hamilton. Provisional directors: Messrs. Geo. Taylor, Jno. McMartin, Louis Henry Timmins, William Griffiths Trethewey, Alexander Longwell, David Alexander Dunlop and William John Blair.

Temagami Iron Mining Company, Limited.—Capital $40,000.00, in shares of $100.00 each. Head office, Toronto. Provisional directors: Messrs. Thos. Boyd Caldwell, Herbert Watson Fleury, William James Fleury, Boyd Alexander, Conyngham Caldwell, Wm. Mulock the younger and Donald Wm. Falconer Caldwell.

Cobalt Silver & Copper Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each. Head office, Sault Ste. Marie, Ont. Provisional directors: Messrs. Frank Eugene Ketchum, Geo. Porterfield McCallum, Cyrus Wm. Baldwin, Christopher John Brook and Charles Henry MacBean.

Queen City Mining and Development Company, Limited—Capital $150,000.00, in shares of $5.00 each. Head office, Toronto. Provisional directors: John Brush LeRoy, John Russell Hemphreys and Thos. Mitchell.

The Savage Mine of Cobalt, Limited.—Capital $500,000.00, in shares of $1.00 each. Head office, Toronto. Provisional directors: Messrs. Gordon Taylor, Geo. Wishart Spence, Lilian Murray Heal, Susan Whitaker and Ada May Duncan.

Cobalt North Ontario Mining Company, Limited.—Capital $40,000.00, in shares of $1.00 each. Head office, Haileybury, Ont. Provisional directors: Messrs. Joseph Edmund Myers, Geo. Albert Mason and William Harrison Altman.

The Williamson Marks Mines, Limited.—Capital $300,000.00 in shares of $1.00 each. Head office, Toronto. Provisional directors: Messrs. Henry Walter Williamson, Ira Marks and James Playfair.

Red Rock Silver Mining Company, Limited.—Capital $1,000,000.00, in shares of $1.00 each. Head office, Haileybury, Ont. Provisional directors: Messrs. David Alexander Dunlop, Noah Anthony Timmins, Melvin Geo. Hunt, Robert McBride and Henry McBride.

Tarentorus Mining Company, Limited.—Capital $700,000.00 in shares of $1.00 each. Head office, Sault Ste. Marie, Ont. Provisional directors: Messrs. Andrew Edwards, Robert Hector McAllister, Samuel Geo. McAllister, Alexander Vallier and John Charles Curtain.

BRITISH COLUMBIA.

Eureka Copper Mines, Limited.—Capital $250,000.00, in one million shares of 25 cents each.

Prince Henry Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each.

Southern Cross Copper Mine Company, Limited.—Capital £150,000, in 150,000 shares of £1 each.

Williams Creek Dredging, Transportation and Agency Company, Limited.—Capital $50.000.00, in shares of $10.00 each.

NOVA SCOTIA MINING INTELLIGENCE.

Memo of mining areas in Nova Scotia applied for under Prospecting License during month of March:—

DISTRICT.	AREA.
Oldham District	12
Stormont	165
Gold River	20
East Rawdon	6
Shelburne Harbour	24
Montague	12
Leipsigate	22
Mill Village	9
Voglers Cove	6
Malaga	12
Cow Bay	11
Uniacke	3

CHIBBOUGAMOU MINING DISTRICT.

An interesting and important report on the Chibougamou mining region, by Mr. A. P. Low, has just appeared as a publication of the Geological Survey. The live interest which is now being taken in the affairs of Chibougamou, and the growing sense of the importance of the mining industries of the northern part of the Province of Quebec, as well as Mr. Low's particular fitness for this investigation, will make the report one of exceptional value and importance. The report covers the work of two months during the season of 1905 by Mr. Low and party. It comprises 61 pages and is accompanied by an index map. For the benefit of those proposing to visit the region, the various routes are discussed, and that which is considered the best, via Lake St. John and the Chamuchuan River, are described in detail. The geological features of all the principal routes of travel throughout the district are described, and the economic possibilities of the locality concisely discussed. The portion of country described in this report is drained by streams emptying into the Nottaway and Rupert rivers, both of which discharge into the southeastern part of James Bay. It is, roughly, eighty miles from east to west; seventy from north to south. The southern boundary of the area is about 280 miles north of Ottawa city, and lies directly north of the country between Montreal and Ottawa. Three possible routes from the south are by way of the Gatineau, the St. Maurice and the Chamuchuan rivers. The last is considered by Mr. Low the best. Details of this route have been given by Mr. J. E. Hardman, in a paper on this district, which appeared in the last September number of the Review, and so they may be omitted from this brief resumé.

The region is described as a rolling table land, having a general elevation of 1,400 feet above sea level at the southern boundary, near the water shed, and following generally to less than 900 feet in the northwest part. The general surface is broken by long, low ridges of rocky hills, which, in a few places, are more than fifty feet above the surrounding water levels, and whose general trend is from northeast to southwest. Where the ridges are close together the intervening valleys contain swamps, drained by small brooks; but more often the ridges are wide apart and the shallow valleys are covered with networks of lakes, fringed with swampy land. As the lands under consideration are from 900 to 1,500 feet above the sea, it is doubtful if they will ever be available for purposes of agriculture, though they may serve as grazing lands.

More than three quarters of the surface of the region is occupied by igneous rocks,. leaving only comparatively small areas to the sedimentary. The latter consist chiefly of the limestones and dolomites of Mistassini, which, from their resemblance to the Upper Huronian limestones about Lake Superior, are possibly of that age; and conglomerates and arkose rocks, which are taken to be the same age as the similar rocks at the west of Lake Temiskamingue. Kewatin schists, older than these, are probably also present. There are also highly crystaline gneisses and schists, which resemble the Grenville series of the Laurentian, whose alteration has been so complete that it cannot be told whether they were originally igneous rocks or sedimates. Of the undoubted igneous rocks diabase occupies the largest area, and is the oldest. It is cut by masses of gabbro and anothosite rocks, and also by as many as three different kinds of granite. The asbestos-bearing serpentine, which thus far is the most important rock of the district, economically, may be an alteration of product of the diabase just mentioned. It is therefore a matter of doubt whether it is of Lower Huronian age, or belongs to the older Kewatin rocks of similar composition.

The important minerals of the district are gold, copper and asbestos, all of which are found in the serpentine and diabase rock. Gold occurs in a large quartz lense, having a total width of forty feet, and a proved length of 500 feet. The gold is found both free and in combination with sulphides of iron and copper. The highest return from a single assay quoted is $11.48 to the ton. The average value of a number of gold-bearing specimens taken by Mr. Hardman was $3.14 per ton. There are a number of other quartz veins which have been sampled throughout the region, but thus far they have not yielded gold. Copper has not been found in important amounts, as yet, but is known to occur in many places in diabase along its contract with the intruded granites. Some exploratory work has been done on a few of these, but they have not thus far proved successful.

The asbestos deposits are considered by Mr. Low to be geologically similar to those of Thetford and Black Lake, and, from the size of the veins and the quality of the mineral, be ultimately of much economic importance. At present, however, transportation charges from the railway at Lake St. John are about fifteen cents per pound. Even if reduced by one half, by making a winter road, they would still be so great as to effectually prevent the successful operation of the property. Mr. Low, therefore, concludes that the success of the Chibougamou mining camp depends upon the building of hte railway to Lake Chibogamoo. - This from the nearest point in a line of railway already built is a distance of 205 miles.

INDUSTRIAL NOTES.

In many classes of electrical work a wide speed variation is required and to meet the demands of such service the Westinghouse Electric & Mfg. Company has developed a line of direct current motors having a speed range of four to one on a single voltage. This wide speed variation is obtained by field control, and the type SA motors compare favorably in every respect with the best direct-current constant-speed machines.

The new motors are exactly similar mechanically and electrically to the Westinghouse type S motors except for the addition of auxiliary poles and coils. These are introduced in order to control the field form during the variation of field strength necessary to obtain so wide a range of speed. The cast steel poles with machine-formed coils are placed midway between the main poles and securely bolted to the frame. The construction is very simple and introduces no complications whatever, nor does it make difficult the removal of the main poles and field coils, as is evidenced by the fact that an auxiliary pole and coil can easily be taken out, without in any way disturbing the main field winding, by simply disconnecting the coil connections, withdrawing the bolts which hold the pole to the frame and sliding the pole and coil out parallel to the shaft.

The auxiliary field winding is connected in series with the armature and therefore produces a magnetizing effect which is proportional to the armature current. The auxiliary coils are placed as close to the armature surface as mechanical considerations will permit and their turns are concentrated at that point. This arrangement adds materially to the performance of the motor as it applies to the corrective influences of the auxiliary winding directly at the points where the distorting effect of the armature current is strongest. This arrangement is much more effective than the distribution of the ampere turns along the length of the auxiliary poles. The magnetic field of the auxiliary winding acts in direct opposition to that produced by the armature current. The resultant field is made up of three components—that due to the shunt winding, that due to armature reaction, and that due to the auxiliary windings. The field distortion usually produced by armature reaction is therefore overcome and the shape of the magnetic field at the point of commutation is maintained as formed by the main poles, and good commutation is made possible over a wide range of speed.

Type SA motors are shunt wound, which gives a definite speed for each point of the controller, which is nearly constant for all loads. Heavy overloads may be momentarily developed without injurious sparking. The motors are reversible without danger and without readjustment of the brushes, and, as the armature and auxiliary windings are connected permanently in series, it is only necessary to change the external armature connections to reverse the directions of rotation.

These motors develop their full rated output throughout their entire range of speed. They will carry full rated load at any speed within their range for six hours with a temperature rise not exceeding 40 degrees cent. in armature and field, and not exceeding 45 degrees cent. on commutator, as measured by thermometer. At all loads and all speeds commutation is excellent, and an overload of 25 per cent. may be carried for one hour without injurious sparking. All motors are thoroughly ventilated, running cool and at a uniform temperature. Their efficiency is high and their speed regulation practically exact. With the exceptions noted, type SA motors are mechanically identical with the type S, and corresponding parts are interchangeable.

The Westinghouse Machine Company, of Pittsburg, Pa. on March 9th filed a second bill of complaint against the Allis-Chalmers Company, of Milwaukee, Wis., in the United States Circuit Court for the District of New Jersey, in which the latter concern is charged with the infringement of a certain patent relating to the manufacture of the Parsons Steam Turbine.

It will be remembered that the Westinghouse Company filed a similar bill in the same Court about a month ago; but while the patent which in that suit related to the method of fastening the blades into the rotating and stationary elements of the turbine, this last patent is even of a more important character. In the bill filed on March 9th the Westinghouse Company alleges that the Allis-Chalmers Company in the manufacture of the Parsons type of turbine is infringing upon the patent number 639,608 of Dec. 19th, 1899 which protects a method of tying the outer ends of the blades together so as to prevent vibration or the breaking of the longer blades.

The outcome of this litigation is watched with interest by all users and manufacturers of steam turbines, particularly on account of the fact that the use of these engines is increasing to enormous proportions. The Westinghouse people claim to be the largest manufacturers of this style of steam engine in the country, having been the pioneers in that field.

They have over 500 in operation throughout the country aggregating a capacity of about 1,000,000 horse power, while at the present time there are under construction in their shops at East Pittsburg 100 units of these turbines approximating a total of one quarter million horse power.

The remarkable strides recently made in the design and construction of large gas engine units both in this country and abroad, have clearly indicated that the possibilities for the application of that form of prime mover are practically limitless.

German builders were among the first to appreciate this fact, and, as a result, have perfected the best types so far produced. American builders, however, have not been slow to see the advantages offered by large units, and the Allis-Chalmers Company of Milwaukee, for one, has been placing before the purchasing public, for some months past, its Gas Engines of the Nurnberg type, in capacities ranging from 300 to 5,000 horse power and for all power purposes.

An 1,800 B.H.P. Allis-Chalmers Unit was recently ordered for the Crystal City, Mo., plant of the Pittsburg Plate Glass Co. It is of the well known four cycle, double acting type, direct coupled to a 1,000 K.W. Allis-Chalmers generator.

The Illinois Steel Company, Chicago, at present using a large number of Allis-Chalmers steam units of various kinds, has very recently ordered two large gas engine generating units, twin tandem type, 1,000 K.W. each. These machines will be installed in the company's present power plant for lighting and power purposes.

To meet the requirements of their increasing business, Allis-Chalmers-Bullock, Limited, of Montreal, have made a number of additions to their sales organization. Among them is Mr. T. J. Lynch, who has been appointed district manager at Toronto. He is already well known there having for two years superintended on behalf of the Allis-Chalmers Company, of Milwaukee, the construction of the fifteen million gallon pumping engine for the City of Toronto. Previous to that he was connected with the Metropolitan Water Works and Sewage Commission of Boston.

Allis-Chalmers-Bullock, Limited, under the new management have entered on an aggressive policy in the pursuit of business. They have leased a suite of offices in the new Trader's Bank in Toronto, added to their office staffs in New Glasgow and Winnipeg, and are spending a large sum of money in improving the equipment of their shops at Montreal. The plant is running night and day to keep pace with orders received and further important additions to it are contemplated in the very near future.

The W. S. Tyler Company, Cleveland, Ohio, the well known manufacturer of wire cloth screens and ornamental iron work, have just issued a handsomely illustrated catalogue (No. 24). The many varieties of ornamental iron work manufactured by the W. S. Tyler Company afford excellent subjects for illustration, and they are well shown in admirably executed half-tones. The catalogue contains 92 pages, is printed on a fine quality of paper, and is artistically bound. It is alike creditable to the firm and useful to its patrons.

MINING NOTES.

(From Our Special Correspondent.)

BRITISH COLUMBIA.

Mining in a sense has been slack here during the past month owing to the state of the roads. But preparations have been made for active work on many of the smaller properties during the coming season and the properties which have already been developed have shown the tremendous impetus that has recently been given to the industry when it is stated that upwards of 425,000 tons of ore have been shipped during the first quarter of the year, that is at the rate of 1,700,000 tons for the whole year. This represents on a conservative estimate a value of $3,500,000 for the first three months of 1906 and includes nothing but gold, silver, copper and lead, the zinc shipments which have not been regularly made up to the present, not being accounted herein. Half of the value is represented by the enormous shipments from the Boundary, while Rossland, the Slocan and Kootenay turnish the remainder in about equal shares.

But the value of the zinc ore is likely to sensibly increase the year's estimates. Already the Bluebell mine is shipping its ore for concentration and separation at the Fernau plant at Pilot Bay, on Kootenay lake, which product will afterwards figure, partly, in the returns of the zinc smelter at Frank, as soon as that plant is ready for operation. The Aurora mine, close by the famous St. Eugene, has already sent a preparatory shipment to Frank and so have half a dozen or more other properties. All these, however, may be considered for the present as merely tentative shipments, more or less for experimental purposes, although it must be taken for granted, seeing the expressed opinion of J. C. Fernau and the amount of money which he has caused to be expended on the erection of his zinc plant, that many if not all of these tentative shipments will prove regular sources of a supply of zinc ore.

It may also be noted that the North Star mine has entered upon a new period of its existence and is again shipping ore, about 1,000 tons being sent during the month of March to the C.P.R. smelter at Trail. The North Star mine was one of the largest shippers in East Kootenay being situated near the Sullivan where a new smelter has been erected by the American Smelter combine at Marysville, which is now treating about 500 tons daily and from which a larger output is to be expected as soon as arrangements have been properly effected. One reason for the increased shipments from mines such as the North Star is the recent lowering in the rates of smelting made by the smelters at Trail and Nelson. This again is partly due to increased facilities of railroad transportation and perhaps more to the economies effected by the new process of desulphurizing ores generally known as the Heberlein method. The Hall Mines smelter and the Canadian Reduction works, at Nelson and Trail respectively, are making large and expensive improvements in this direction and the fruit of these improvements is being seen in the increased output from the district in general.

There has been some trouble in the Boundary over the question of power for the mines and smelters which, up to the present, has not been satisfactorily adjusted. That an adjustment will take place is evidently the opinion in the Boundary as the B.C. Copper Company is going ahead with the enlargement of its plant. The trouble is over a contest between the Cascade Power Company and that known as the West Kootenay as to who shall supply the power for the Boundary people. The management of the Granby, according to reports appearing in Washington papers, has acquired a source of power on the Columbia river over the boundary line and expect to be permitted to transmit the power proposed to be generated there to British Columbia. Probably this will not seriously be pressed unless the trouble between the rival power companies within the province leads to a close down of some of the mines or smelters because of lack of power.

Rossland again is having a spasm of high grade ore discoveries. From time to time high grade streaks of ore are found in the mines, especially in the vicinity of the Josie dyke, a dyke which runs through some of the principal properties and west of which very little mining has been done in comparison with that done to the east of the dyke. This is sometimes in connection with the occurrence of extremely rich knife like layers of sylvanite, sweetening the whole ore body, as for instance upon the Annie, one of the Le Roi No. 2 properties. Lord Ernest Hamilton lately announced in Nelson the possession of such a streak of high grade ore upon the Le Roi No. 2, of which company he is chairman. A somewhat similar discovery has been announced in connection with the Le Roi itself, which, like that of the old subsidiary company, is in connection with the Josie dyke. However, the main ore body of the Le Roi is a large one and is, in fact, a shear zone, rather than a true fissure, the ore being mineralized from a certain portion of the ore body outwards each way, gradually dwindling to unremunerative ground. Hence it is a desideratum in the mining of Le Roi ore to ship as much of the vein as is possible, so that the vein shall not be "gophered" by taking out merely the richest portions. The Le Roi No. 2 has not nearly as large an ore body. It has several and the copper values are generally very much stronger than those of the larger property. Hence the mining of the one and the mining of the other cannot well be compared as seems to have been attempted in London during the struggle for the management of the Le Roi. Generally there is a feeling of distrust in Rossland as to the method in which the Le Roi has been worked in times past. In the spring of 1902 it was announced that the Le Roi values had fallen to a point which was below commercial returns. The stock immediately fell in price, yet, within the last six months of that same year the Le Roi paid $600,000 dollars profits. The manager was then changed and within a year the same startling discovery as that of 1902 was made and there was another slump followed by another declaration of profits. As it is publicly announced in Rossland, even now, that all strikes must first of all be reported to the dictorate in London, these extraordinary fluctuations are commented upon adversely and are tersely summed up in the expressed opinion of an old manager, Bernard Macdonald, after returning from a visit to the old country. He said, "The London men do not ? a mine all they care about is a hole in the ground on which they may gamble!"

F. W. Rolt's letter, appearing in the March issue of the Canadian Mining Review, shows these very points strongly enough in the figures which he quotes. He is, of course, arguing in favour of the mine not running its own smelter, saying nothing as to the fact that the successful mines of the district, large mines, are putting their ores through their own smelters, in order that the profit of smelting should be added to the profit of mining, a very necessary thing indeed when the ore is low grade and in large bodies. One word here may be said as to the costs of smelting in Northport. It may be noted that in an English article upon the Hunter V. mine at Ymir, which supplies lime to both Trail and Northport that the cost of the lime at Trail is more than double than the cost of the same rock at Northport, 65 cents and $1.50 a ton being approximately the figures, given in English money. Hence it may be seen that the course being taken by Mr. A. J. McMillan, has something to recommend it, although, like nearly all his predecessors in the Le Roi, he may make a mistake. All the predecessors, however, have not acknowledged their mistakes but have occasionally, like manager Macdonald charged them up to the alleged gambling proclivities of the head people in London.

Southeast Kootenay.—The shipments of silver-lead ore from Southeast Kootenay show that for the first two months of the year that 7,759 tons have been sent to the smelters, a large increase over the output of 1905.

Slocan.—The Bluebell mine is now making steady shipments to the Frank smelter.

The ore shipments for the week were 20 tons of silver-lead from the Reco and 20 from the Ruth.

A fine body of rich ore has been struck in the upper tunnel of the Mercury. A carload will be out in a few days.

The Silver Glance at Bear Lake has closed down for a time on account of slides.

Ore is being rawhided down from the Sunset and stored at the freight shed at Cody.

The owners of the Index mine on the South Fork forwarded a few days ago over a ton of supplies, and intend immediately putting to work a crew of men to fully prospect the property.

The new manager of the Cork has decided to enlarge the mill and double its capacity.—From the Rossland *Miner*.

Boundary.—Satisfactory results seem to have followed the shipments of ore from the Napoleon mine, near Marcus, Washington, controlled by the B.C. Copper Company. A small development plant has recently been installed at the mine, consisting of a 5 drill Rand compressor, 50 h.p. boiler, etc. At present the ore is hauled on wagons or sleighs to the railway siding, but surveys have been made for both gravity and aerial trams. The main tunnel is now in over 200 feet.

A piece of giant powder went off in one of the furnaces of the Dominion smelter at Boundary falls, damaging one of the water jackets and requiring repairs. Occasionally this happens in nearly all smelters.

In the tunnel being driven on the Iron Clad, Wellington camp, good galena ore has been encountered. The owners are W. J. Porter, G. W. Rumberger and Jack Farrell.

It is expected that more work will be done this spring on the Monte Cristo group, north of Phœnix, acquired some time ago by the Granby company to prove the ore bodies.

The B.C. claim, situated on the west fork, has proven rich in gold and silver, a recent assay giving $1,700 in gold and $278 in silver. The ledge varies in width from 18 inches to 4 feet, and has been traced for 3,000 feet. The claim gives promise of becoming a valuable property.

A steel plant is about to be established at Grand Forks. The contract has been let for the erection of a building 40 x 60 feet, which will be built in connection with the Boundary Iron Works. The new plant will employ some ten men at the outset.

ONTARIO.

Two formerly worked mica mines near Bancroft are to be re-opened in the early spring.

The Atlas Arsenical Company, Manager Mr.W. Hungerford, of Belleville, are making preparations to develop a property of some five acres extent, which was recently purchased in the Deloro district. A shaft of 180 feet was sunk some time ago, and there are said to be indications that gold and arsenic, in paying quantities, will be taken out this season.

The Copper mine at Eldorado is going ahead splendidly. Carloads of copper are being shipped to the Nichols Chemical Co. for treatment and are bringing in big profits. New drills and other machinery are being installed. A new smelter of 50 tons daily capacity will be in operation in May of this year. This promises to be one of the most profitable mines of the county.

The Stanley Smelting Works at Bannockburn shipped a carload of pig lead to Toronto this week. The price $98 per ton is phenomenally high. They are having good success with the new smelter which is running continuously. Hematite iron from the old Eldorado mine is used for fluxing purposes. All the lead mines of the company will be operated soon. The company have re-organized on a much larger basis and will develop the lead industry on an extensive scale.

A large steel rolling plant for Port Arthur is the latest Mackenzie & Mann scheme. This was announced by Messrs. MacKenzie & Mann's representative at Port Arthur, who stated that after the erection of the smelter at Port Arthur, the Company would construct an extensive rolling mill plant there. This will be the first of its kind in Western Canada. The reason given is that the Company has discovered that the quality of ore secured there is specially adapted for the manufacture of high grade steel.

No steel rail mill is in contemplation as yet, the company simply intending to convert its own pig iron into steel rods, etc.

NOVA SCOTIA.

Dr. McLennan, M.P. for Inverness, N.S., has recently brought to Ottawa some samples of coal from a newly discovered seam at Mabou. The specimens are said to be of a very superior quality.

Messrs. M. P. MacNeil & Co., of New Glasgow, have secured the contract for erecting a number of buildings at the Allan Shafts for the Acadia Coal Company. It is understood that the contract calls for buildings costing in the vicinity of fifty thousand dollars, and which will be all fireproof. The machinery used for the Allan Shafts will be of the most modern design. The sinking is now down fifteen hundred feet, and their plans are to leave a barrier of three hundred feet between the shafts and the old Ford Pit, which is still believed to be on fire.

QUEBEC.

The Calumet Graphite Mining and Milling Company, which has been operating for some time a graphite property near Calumet station on the Canadian Pacific, has decided to erect a modern graphite milling plant on its property, and it is reported that the Krom Machine Works, of Jersey City, N.J., have received the contract for the necessary machinery. The property has been opened up to a considerable extent. One shaft on the slope of a hill has a depth of 80 ft., following several graphite veins of columnar and scaly structure. A tunnel commenced at the foot of a hill will be driven toward the shaft, the bottom of which is 90 feet above the tunnel level. There are a number of openings all over the crest of the hill, showing more or less the occurrence of the scaly variety in a disseminated form through limestone and quartz. The area owned by the company comprises 258 acres. Some 60 tons of the vein graphite mined in the shaft have been sent to the Globe Refining Company, New York, some time ago, and yielded 32 tons of good crucible material, which has been used in the manufacture of crucibles to good advantage by English and German manufacturers.

COMPANY MEETINGS AND REPORTS.

At the annual meeting of the Nova Scotia Steel & Coal Co., held at New Glasgow, N.S., March 29, the fifth annual report of directors showed volume of general iron and steel business transacted by the company last year was larger than that of any previous year, increase being 28,825 tons, and in value being $597,887.37.

From the steel department 28,225 tons of finished matter was shipped, and 28,723 tons of pig iron was sold. There are orders on the books for much larger tonnage of steel and pig iron at higher prices, than have prevailed last year. The quantity of coal mined was 58,141 tons more than the previous year. Profits for the year were $359,906.63, making total of $1,255,656.-44, at credit of profit and loss account.

The general manager reported on the operations of the year, referred to the great inconvenience to shipping caused by large snow fall of winter of 1904-05, which necessitated an extra expenditure of from $25,000 to $40,000.

He referred also to the opening up of marine areas and stated that the outlook for the year was most satisfactory. The report was adopted and satisfaction was expressed at the operations of the year.

The following were re-appointed directors: J. Walter Allison, Robert F. Harris, Thos. Cantley, Harvey Graham, Hon. Robert Jaffray, Hon. L. Melvin Jones, Jas. C. McGregor, G. F. McKay, John MacNab, Hon. J. S. Pitts, Robert Reford and Geo. Stairs.

R. E. Harris, K.C., was re-elected president, and Hon. J. H. McGregor, vice-president; J. H. McGregor and F. H. Oxley were re-appointed auditors.

The following now constitute the official staff of the Nova Scotia Steel & Coal Co's coal department: T. J. Brown, General Superintendent; John Johnstone, Coal Mining Superintendent and Manager of Queen Pit; R. C. Brown, Manager Sydney No. 1; G. Greenwell, Manager No. 3.

The Globe Refining Company contemplate an increase of their plant at their graphite mines of North Elmsley, Ont. This company now owns a refinery located at Port Elmsley, close to the C.P.R., where they have a water power said to be about 200 h.p. Ten or twelve men are now employed, and an excellent quality of graphite is reported to have been found.

The Consolidated Mining & Smelting Company.—An interesting official report of this company is at hand. The paid-up capital is $4,698,888, and the authorized capital $5,500,-000. The directors are: W. D. Matthews, president; George Sumner (Montreal), vice-president; E. B. Osler, Chas. R. Hosmer, H. S. Osler and W. L. Matthews. W. H. Aldridge, Trail, B.C., is managing director of the combine, which comprises a consolidation of the St. Eugene, War Eagle, Centre Star, Trail Smelter and Rossland Power Co.

Centre Star.—Since the report of 1904, 111,841 tons of ore have been shipped, having a gross value of $11.28 per ton, or a total value of $1,261,390.01. The net amount received by the company for this ore, after deducting all freight, smelter, refining and marketing charges, was $503,476.31, or an average of $5.39 per ton. The ore showing in the mine promises to yield over 100,000 tons ore of $10 gross value, which does not include the ore being opened up on the tenth level. The mine is now shipping about 9,000 tons of ore monthly, averaging about $10 per ton gross value.

War Eagle.—Shipped in 1905, 60,860 tons, valued at $690,269. Net return to company, $317,775. The mine is shipping 5,000 tons per month of $10 ore.

St. Eugene.—In 1905 yielded a gross product of $1,820,011, or $52.93 per ton. Net return was $1,232,893.

Trail Smelter.—In 1906 treated 240,000 tons of ore, producing $806,658 silver, $1,708,257 gold, $563,249 of copper, and $397,580 of lead.

Consolidated Company.—The Consolidated Company started with a cash working capital of $596,669.57, which is invested in ores and products in process of treatment and in transit. The company has a liquid asset in the shape of fuel, fluxes and supplies, valued at $202,220.43. Deducting operating, development and construction expenses from the net receipts from ore shipment, as above, the net profits of these properties (including the profits of the smelter) during 1905, were over $700,000, and it is expected that the company will do at least as well during the year 1906. Due to the consolidation of the properties and to the larger tonnage being handled, much lower grade ore can be profitably treated than formerly.

It is notable that the lower portions of the workings of the Centre Star and War Eagle are looking well, and are certain to yield a large and valuable tonnage of ore.

The Dominion Coal Company, Ltd.—The report of this company, presented at its annual meeting on March 1st, showed that the output of 1905 was 3,189,657 tons as compared with 3,923,522 tons for 1904. The general business of the company during 1905 was well up to the standard of 1904, but the largely increased requirements of the Dominion Iron & Steel Company necessitated an increased output from the mines, and as the contract with that company is not at present a remunerative one, the average price realized from sales in 1905 was consequently less than in 1904. The surplus earnings, not providing for interest on bonds, preferred stock, dividends, etc., have been added to the company's general surplus. The total amount expended during the year 1905 on capital account, including the purchase of steel cars, is $497,605.19. The company's financial position has greatly improved during the year 1905. Five million dollars of five per cent. bonds have been substituted for $2,435,000.00 of six per cent. bonds, $2,380,000.00 time notes and $3,000,000.00 of seven per cent. preferred stock has been substituted for a like amount of eight per cent. These changes will effect a large saving in fixed charges.

The company has laid before its employees a scheme for the purchase of their homes on the instalment plan, and it is expected that this will be largely taken advantage of in May by the commission. It is thought that the workmen will thereby gain in becoming owners of their houses, and the company are securing a more permanent body of employees in consequence. The directors elected were: Lord Strathcona, Sir W. C. Van Horne, Messrs. R. B. Angus, James Ross, J. R. Wilson, F. L. Wanklin, The Hon. Geo. A. Cox, Mr. W. D. Matthews, The Hon. David McKeen, W. B. Ross, K.C., Mr. F. F. Dimock and Mr. F. S. Pearson.

At the recent annual meeting of the Wellman-Seaver-Morgan Company of Cleveland, Ohio, the office of general manager, which has been vacant since the death last June of Mr. Charles H. Wellman, was filled by the election of Mr. S. H. Pitkin, whose present title will be first vice-president and general manager. Otherwise no changes were made in the officers of the company.

A meeting of the bondholders of the Port Hood Colliery Company was held at Montreal, March 31st, and it was arranged that a reorganization of the company should take place. Among those present at the meeting were Mr. James Terrill, Halifax, solicitor for the company; Mr. D. F. McLean, mayor of Port Hood, and Robert J. Bell, manager.

MINING MEN AND AFFAIRS.

Mr. J. E. Hardman, a mining engineer, is at present in the South Atlantic States, on professional business. He is expected to return about the middle of April.

Mr. H. C. Symmes, Mechanical Inspector of the Department of Mines of the Transvaal, who has just completed a six months furlough in Canada, set out on his return trip to Johannesburg on the 25th ulto. Mr. Symmes is a Canadian by birth, a graduate of McGill University, and has been a resident in South Africa ever since the war, during which he served with distinction in the Royal Canadian Artillery.

Mr. A. P. Low, Director of the Geological Survey of Canada, delivered a lecture to the members of the Canadian Club at the St. Lawrence Hall, Monday evening, April 2nd, on the subject of "the Resources of the Artic Region and the Navigation of Hudson's Bay."

It is reported that Colonel Conrad, of Windy Arm, Alaska, who has been until recently at Toronto, but who left there a few days ago, has succeeded in his mission of disposing of his property to a Toronto syndicate. Rumor has it that Mr. William Mackenzie, president of the Canadian Northern, and of the Toronto Railway Company, is the chief representative in the syndicate, and that the amount involved is five million dollars. The property in question consists of ten claims on Windy Arm near White Horse, and was originally bought by a Seattle syndicate for $160,000.

Mr. James McEvoy, C.E., geologist of the Crow's Nest Coal Co., is now chief engineer as well having been appointed to succeed Mr. H. B. Wright, C.E. who has left the service of the company.

W. G. Tretheway, so well known in connection with Cobalt silver developments, was recently called to British Columbia by the serious illness of his father.

Prof. W. G. Miller, of the Ontario Bureau of Mines, is publishing a book, the title of which will be, Minerals and how they Occur.

As a result of meetings recently held in Toronto a new industry for the manufacture of soda ash is to be established near Sandwich, in the county of Essex, where some 50 or 60 acres of salt lands and 10 acres of limestone have been secured. A company composed of British, United States and Canadian capitalists is being formed, with a capital of $1,000,000. Considerable preliminary work has already been done. The government is being asked to increase the duty on imported soda ash, but consumers are strongly opposed.

The ore shipped from the Cobalt mining camp during 1905, is stated to have aggregated 2144 tons, of the value of $1,448,524. These figures are likely to be far exceeded this year. The value last year was largely reduced by the fact that little or nothing was received for the Cobalt, nickel and arsenic which the ore contained.

Hon. Mr. Foy, attorney general for Ontario, has introduced a bill which will place mining companies on the same footing as other joint stock companies.

Some very good bricks have just been taken out of the Sultana mine from ore which runs over $7 a ton on the plates, besides the concentrates. A very large body of this ore has been found, which continues across the Sultana property. Arrangements are being made to work the adjoining properties, but the matter has not taken very definite shape yet.

A deposit of high grade copper was found some time ago on the Temagami Forest Reserve. The vein, which is supposed to be about 12 feet wide, has been traced for a quarter of a mile. Some development work has been done under permit, but there is a difficulty as to the pine timber. Affidavits have been fyled to the effect that the timber would not be injured, and the government is being asked to deal with it.

The statement made by a Toronto publication that the United States Steel Corporation has definitely decided to erect works in Canada is premature. After looking carefully into the conditions they have decided that the cost of building is too great at present to justify the erection of works in Canada.

The township of Coleman, in which Cobalt is situated, has been organized municipally and will have its local Board of Health to deal with the sanitary questions which always arise in a new mining camp. A sanitary inspector has been appointed to assist the local authorities.

The Savage-Cobalt Mining Co. finds like the other mines which have gone down some distance, that their ore body increases in value as they go down. Their shaft is now down about 70 feet and their main vein has widened twice in that distance being now between five and six inches. The ore continues to hold its value. There was for a time considerable difficulty with water, but since a large pump and other machinery was installed there has been no further trouble. This company claims to have ten distinct veins on two acres of their claim, with 40 acres not yet prospected.

New finds of Cobalt ore are said to have been made at Montreal River, but the ore does not carry the quantity of silver which is found in the township of Coleman, though the veins are wider. In the township of Bucke, which adjoins Coleman, several discoveries have been made, the richest being on what is known as the McBride property, N.W. ¼ of the S ½ of lot 14, concession 2. The Green Claim adjoining the McBride and the Leith claim, on the shore of Lake Temiskaming, are also promising. Prospecting in Bucke is very difficult, most of the

Huronian rock being covered with drift. On the McBride claim as opened up the ore is much corroded and the conditions of its occurrence are similar to those at Kerr Lake.

Thomas A. Edison, the great inventor, has an agent on the ground at Cobalt, buying cobalt at 35 cents a pound. Mr. Edison will use it in connection with a new storage battery. As the price fell off last year to a mere nominal figure, the world's consumption being small, the discovery of a new use, with enhanced price, is of great importance.

The Crow's Nest Coal Co. has declared its usual quarterly dividend of 2½ per cent. for the first quarter of the current year. The directors have under consideration a plan for the re-organization of the company, so as to bring its nominal capital more in line with the actual value of the company's holdings. It is probable a special meeting of the shareholders will be called to consider the proposal.

The Temagami Iron Mining Co. has been formed to work the iron deposit at Lake Temagami in which T. S. Caldwell, M.P.; Sir William Mulock and D. O'Connor have each a one-third interest.

An Order-in-Council adds a new clause to the Ontario Mining regulations. It is as follows:—"For filing any agreement, caution of other document, except a transfer, affecting or purporting to affect any mining claim already recorded, the party filing the same shall pay the inspector of the division a fee of two dollars ($2.00) for every claim mentioned or described therein."

The Huron Oil Producers, a company which controls oil territory at Petrolia, recently obtained a charter. A meeting for organization will probably be held in Toronto in April.

A company has been formed to take over and operate the Tretheway mine at Cobalt. W. G. Tretheway, the present owner, will retain enough of the stock to give him a controlling interest.

A number of charters which have been applied for in connection with Cobalt companies are being held over by the Ontario Government till the bill introduced by Mr. Hoyle has been considered and disposed of. This bill is intended to protect the public against wild cat schemes, and if anything can be done in that direction it will be a good move. Some of the companies on whose behalf glowing prospectuses have been issued are nothing but stock jobbing schemes to rob a too confiding public.

Some interesting experiments have been made at Toronto at to the heating properties of different kinds of coal, with a view to greater economy in the city's supply of fuel. Recent tests show that some classes of coal produce seven per cent. more units of heat than others. Property Commissioner Harris has recommended that in future tests be applied to coal furnished to the city under contract.

Hon. A. J. Matheson, provincial treasurer, recently received a cable despatch from the manager of the London branch of the Bank of Montreal, saying that the Rothschilds had made a payment of £100 a ton on a trial shipment of 20 tons of Cobalt ore sent through the Department of Lands and Mines. The experiments made by this wealthy firm with these ores are proving highly satisfactory, and there is no doubt a market for them is opening up in England and on the continent.

Dr. Haanel, superintendent of mines for Canada, gave an account of the experiments made at Sault Ste. Marie in the electrical smelting of iron, before the Canadian Club in Toronto, on March 12. The experiments were carried on from the middle of February till March 5. Although the manufacture of iron by electricity had been successfully accomplished in Europe there were several points which could not be settled there. The experiments at the Sault proved that magnetite could be successfully smelted, as well as hematite; that ore with considerable sulphur content can be made into pig iron of marketable value; that charcoal can be substituted for coke; that ferro-nickel pig can be produced practically free from sulphur from roasted nickeliferous pyrrhotite, and that pyrite cinders, now a waste product, can be turned into pig iron. Much interest is taken in this subject in Toronto, and Dr. Haanel was cordially thanked for his most interesting address.

Toronto parties who have been over the ground report that operations have been resumed on the White Bear mine at Rossland and that the outlook is promising. While in the main, development work will be done for some months, ore shipments will be made from time to time. A new 400 h.p. motor is doing good work driving the air compressor. The company has been re-organized, with a capital of $1,000,000, in shares of 10 cents each. An assessment of 2 cents per share was made to provide a working fund, one cent of which has been called in. White Bear is close to the famous Le Roi property.

Col. J. H. Conrad and his mine manager, Mr. Singer, who have been in Toronto and other eastern cities for some time, have returned to the Pacific Coast. Satisfactory financial arrangements have been completed for the vigorous prosecution of work at the mines on Windy Arm, in which Col. Conrad, who has had wide practical experience is interested.

The copper property in the township of Thompson, district of Algoma, has been acquired by the Northern Ontario Copper Co., which has its head office at Sault Ste. Marie. A drill, hoist and other machinery has been installed and development work is progressing. A shaft has been put down 30 feet and high grade ore exposed, which is of such a character as to be easily smelted.

At the Ideal Gold mine near Dryden, Ont., the Charlton-Wallace Improved Stamp Mill now operating there shows good values. This mill is a combination of stamping and grinding. A new experiment, at least in that section, has been made in roasting the ore before milling. This makes it crush more easily.

The Imperial Plaster Co., of Toronto, which has plaster beds at Cayuga, has installed a crushing plant at that place. The rock after being crushed, is brought to their mill in Toronto to be further treated.

In consequence of the present high price of arsenic, it is rumored that the mine at Deloro, which has been closed down for some time, is to be re-opened.

A report that silver has been found in the township of Belmont, near Havelock, is an old story revived. The presence of silver has long been suspected, but whether there is a deposit of importance, or not, is quite a different story.

The Cobalt ores may be rich but there are mines of other minerals of greater value in Ontario. From the Smith & Lacey Mica Mine, near Sydenham, belonging to the United States General Electrical Co., about $2,000,000 worth of mica has been taken from an area of about one acre, and the mine is still being worked.

The McKinnon & Darragh mine, one of the most valuable of the silver-cobalt mines in the township of Coleman, has been sold to F. B. Chapin and associates of Toronto. The figure is said to be in the neighborhood of $700,000.

Determined action is being taken by the Ontario Government to keep prospectors off the Gillies limits at Cobalt till the timber is removed, which is to be done on the mineralized portion by October 1st, and until a policy in dealing with the limit is decided on. A sufficient number of constables will be employed to keep prospectors off.

Mr. S. J. Ritchie, of Akron, Ohio, during a recent visit to Toronto, expressed himself as being much impressed with the value of certain deposits of granite, marble and sodalite in the northern part of the county of Hastings, and easily accessible by railway. He thinks there is little occasion to use brick for important buildings when such beautiful and durable stone is within easy reach. The sodalite is a beautiful blue and takes a high polish. It is admirably adapted for interior finish. The deposits are being worked to a limited extent under the direction of Thomas Morrison, an Aberdeen man of considerable experience.

Two hundred more mining leases have been cancelled within the past month for non-payment of rent. They covered properties in the districts of Rainy River north, Rainy River south, Thunder Bay, Algoma and Nipissing, and several in the County of Hastings.

The Canadian Pacific Railway is, it is understood, about to extend its lines to Cobalt and other points in Northern Ontario, so as to secure a share of the immense business which is sure to follow mining developments at Cobalt, as well as the tourist business to the Temagami district. The junction with the main line will probably be Sturgeon Falls.

The reduction works at Hamilton, about to be established in what was formerly the Hoepfner refinery, will be carried on under the name of the North American Cobalt Refining Co., with a capital of $1,000,000. Among those interested are L. H. Timmins and W. G. Tretheway, who have given their names to two of the richest mines at Cobalt. John McMartin, of Cornwall, who has large interests at Cobalt, is also one of the Company.

A deputation from the Ontario Clay Products Manufacturing Association recently waited upon the Ontario Government asking that a school for instruction in clay working be established on lines somewhat similar to those in England and Germany. It is suggested that this might be done in connection with the School of Mines at Kingston. There are about 3,500 persons employed in this industry in Ontario.

Large quantities of mining machinery are being taken into Cobalt and installed at the mines ready for this season's operations. The Rothschild Cobalt Co. has ordered an engine, boiler, pump and other equipment, development work to the depth of 57 feet on their main shaft having disclosed the existence of a number of veins of ore. Compressors are being installed at the Drummond and Jacobs mines. The latter has been shipping from 25 to 30 tons a month to New York. One shipment realized $57,000.

A private palace car is making trips between Toronto and Cobalt for the accommodation of parties who wish to investigate with the view of making investments. A number of parties have gone in this way to inspect the Silver Leaf and other properties.

A Winnipeg man who visited the Cobalt district in 1904 was induced to invest $750 in the stock of the Hudson Bay and Temiskaming Mining Co., receiving 1,000 shares at 75 cents. He has just been paid a dividend of $2,000 and his stock is now quoted at $64 a share, even a higher price being asked by holders. All who invest in Cobalt mining stock must not expect such results. This is one of the companies which got in on the ground floor and secured several valuable properties.

The question of the export of natural gas is likely to come before the Ontario Legislature at its present session in such form as to lead to the hope that it will be further curtailed. In 1904 the export to Buffalo from the Welland and Haldimand gas fields is stated to have reached upwards of 1,250,000,000 cubic feet, equivalent in hard coal, with gas at 30 cents, to $450,000.

Strong pressure has been brought to bear on the Ontario Government to grant a liquor license at Cobalt, but so far they have refused to yield. Under the mining regulations the sale of liquor is prohibited within five miles of a working mine.

Considerable interest is attached to the fact that the best ore yet found at the Timmins or La Rose Mine at Cobalt has been taken out at the bottom of the 200 foot level. High grade silver was found away from the vein altogether in the country rock. Five hundred feet of drifting at the 90 foot level also shows good values. Drifting has been commenced at the 200 foot level. This goes to show that the values at Cobalt are not confined to the surface as was at one time feared.

IMPORTANT MINING SUIT.

Mr. Justice Mabee has given judgment in a case involving the right to a very valuable property at Cobalt, which came up at the Toronto non-jury assizes about a month ago, and on which judgment was reserved. The history of the case is as follows. Three men—Murdoch, McLeod, Donald Crawford and Thomas Crawford—arranged in 1904 to go prospecting in the Cobalt silver region. Thomas Crawford was taken ill and the other two men continued the work. While in the woods they met with one John McLeod, who joined their party. The latter located a claim, and it was understood that each of the above was to have a one-fourth interest. The patent was taken out in the name of Thomas Crawford. Without the knowledge or consent of the others he subsequently, for $200 cash and one-fourth of the mineral which should be taken out, sold to Thomas E. Lawson, a mining engineer and prospector, who entered into possession and has since worked the mine. Action was brought in the Court to have the sale by Thos. Crawford to Lawson set aside and for an injunction to restrain the defendant Lawson from working the mine. There were really two actions which were consolidated, Thomas Crawford denying that John McLeod had any rights. The judge holds that there was co-ownership by the two Crawfords and the two McLeods and that each is entitled to a fourth interest, and he sets aside the sale to Lawson, who must also account for the silver taken out while he worked the mine. He further holds that Lawson did not know when he purchased that Thos. Crawford held merely as a trustee, and is therefore innocent of fraud, as alleged by plaintiffs. The day before he bought however he discovered a rich vein, of which he did not tell, but Murdoch, McLeod and Donald Crawford heard of it and refused to recognize the sale. The property is said to be worth $1,000,000. Another suit is pending between Lawson and Thomas Crawford.

Dominion and Nova Scotia Steel share-holders will be interested in the motion brought up at Ottawa by Mr. Conmee for a renewal of a further period of bonuses hitherto granted on the products of Canadian iron and steel mills. These bonuses will lapse shortly unless steps are taken to revive them. The "Toronto News" points out that the present bounties paid by the Government are three in number: (1) That on pig iron; (2) that on the same pig iron converted into steel ingots; (3) that on certain finished articles made from the steel ingots. For 1905 the bounty on pig iron was $1.50 a ton, on ingots, $2.25 per ton, on steel rails, $2.25 per ton, on structural steel $1.65 per ton. On finished steel products the total bounty ran from about $4 to $6 per ton. Mr. Conmee's motion carries a rider, providing that the bounties shall be paid only on products of ore mined in Canada or in another British colony and not on foreign ores, as at present. This restriction would not affect the Dominion Iron and Steel Company or the Nova Scotia Steel Company, which get most of their ores from Newfoundland, but it would work to the disadvantage of the Lake Superior Corporation, which obtains most of its ores from the United States. It is proposed to make up for this to the Superior Company by getting the Government to remit the duty upon coal coked in Canada.

The following are the latest returns for the month of March, of the lead shipments from the Hall mines:

Mine	Ore	Lead
Alice	25,586	16,145
Arlington, Slocan	45,244	3,755
Arlington, Erie	236,768	7,457
Emerald	41,206	26,660
Hewitt	38,107	1,715
Lorna Doone	87,458	7,319
Majestic	36,743	25,610
Mammoth	19,233	5,533
Mountain Boomer	43,939	3,955
Pioneer	39,215	1,176
Reco	84,788	38,512
Ruth	40,369	9,406
St. Eugene	1,961,480	1,028,925
Silver Cup	49,766	6,071
Skylark	41,549	3,739
Standard	79,549	44,052
Sunshine	83,000	36,188
Whitewater	81,855	47,552
Wilcox	62,105	4,812
Ymir	186,164	17,797
Total	3,284,124	1,336,379

Of the total 571 pounds of lead from the St. Eugene belonged to February's shipment.

A recent report from Cobalt says:

One of the biggest deals in mining property in this district that has taken place along the line has just been consummated in the sale of the Nova Scotia mine and Peterson's Lake, in all about 195 acres. The purchasers are Messrs. Jacobs, of the Jacobs mine, Stindler, of New York; Clarkson, of Hamilton; Jas. A. Ogilvie, of Montreal, and A. F. MacLaren, M.P. The price is $700,000. The Nova Scotia mine gives promise of great wealth. Peterson's Lake and Cart Lake, which adjoin, will be drained by the new owners to get at the silver in the bottom of the lakes.

The Ontario Gazette announces the granting of charters to the following companies. The concerns incorporated are the Montreal-Cobalt Mining Co., Limited, with a capital of $500,000; the Shakespeare Development Co., Limited, with a capital of $300,000; the Sterling Silver Cobalt Mining Co., Limited, with a capital of $600,000; the Florence Mining Co., Limited, with a capital of $100,000; the Silver City Mining Co., Limited, with a capital of $250,000; the Wonderland Silver Mining Co., Limited, with a capital of $250 000, and the Silver Land Development Co., Limited, with a capital of $1,000,000. The Mines Publishing Co., Limited, capital $40,000, has also received a charter. It will establish its headquarters in Toronto and publish a periodical or newspaper dealing with mines and mining.

The Galt Malleable Iron Co., with a capital of $100,000, will manufacture and deal in iron and steel fittings, brass, copper and alluminum.

The Owen Sound Brick Co., Limited, capital $40,000, will carry on the erection of buildings, sidewalks, pavements, etc.

The Port Arthur Sand, Lime, Brick Co., Limited, capital $60,000, will deal in sand, lime, brick, cement, and other building material, and contractors' supplies.

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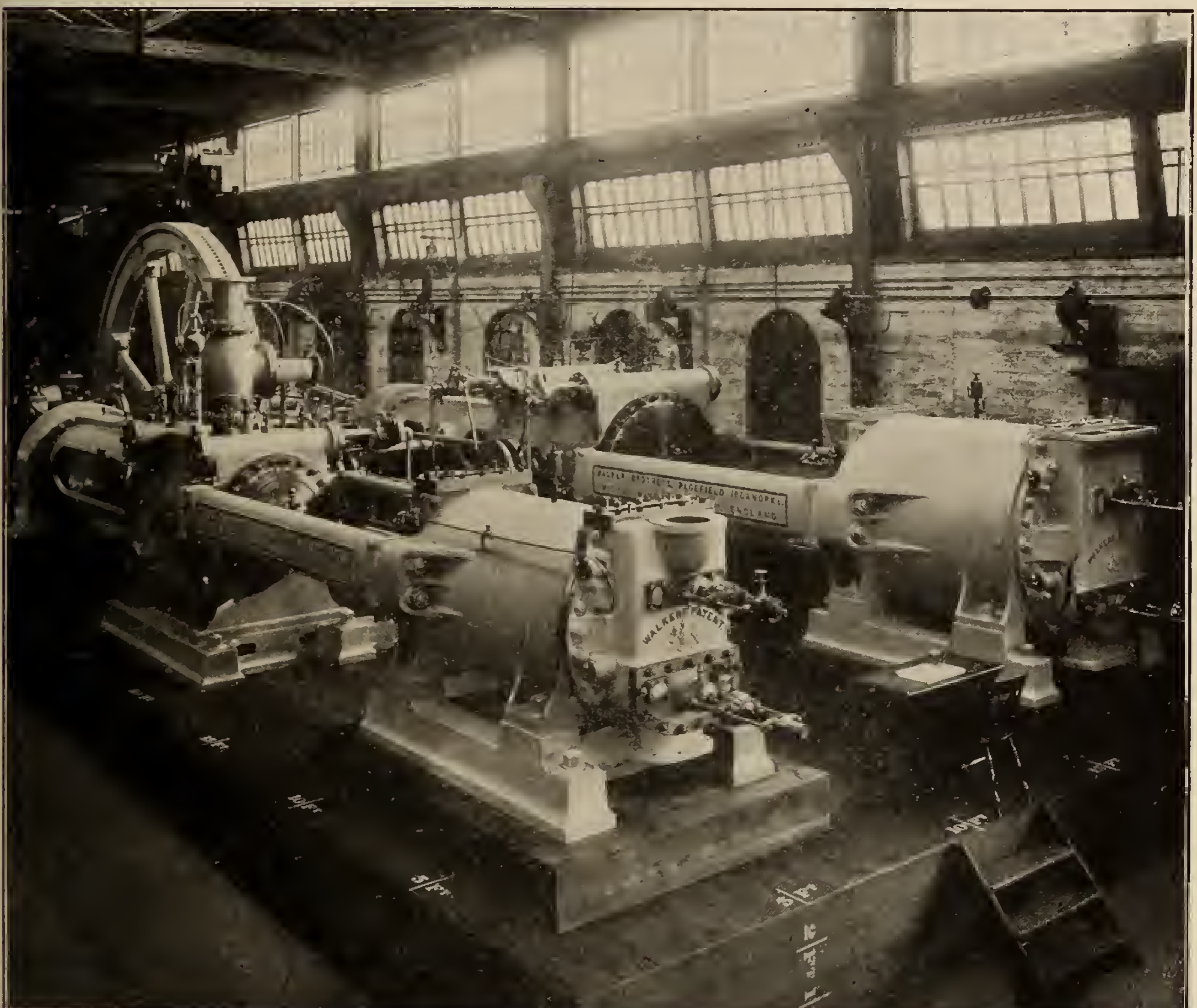

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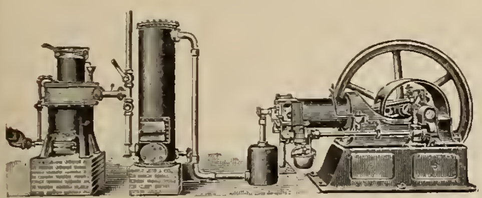

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THE CHIEF GEOLOGIST OF THE GEOLOGICAL SURVEY.

Upon the recent filling of the directorship of the Geological Survey by the appointment of Mr. Low, there was created within that department the new position of Chief Geologist. This is an important step, in as much as it should facilitate the organization and correlation of field work, and it should, accordingly, go to strengthen the hands of the director. It was fitting too, that the first appointee to this position should be Dr. Robert Bell, the senior member of the staff, who for the past five years has filled energetically the position of Acting Director.

THE COPPER SUPPLY.

In a recent number of the *Engineering and Mining Journal*, Dr. James Douglas discusses the comparative quantities of pig iron and copper used during the last ten years. His careful statistical comparison shows that during that time one ton of copper has been consumed for every 83 tons of pig iron, and that this ratio was maintained very uniformly. In order therefore to meet the rapidly growing demands of the iron and steel industries a proportionately rapid increase in the production of copper is required. It is this demand which has given to the copper market its steady advance during recent years, an advance which Dr. Douglas' investigations would indicate to be a perfectly natural one, as there are no known copper reserves of great importance, the copper market is likely, accordingly, to continue active for some time.

PROVINCE OF QUEBEC CHANGE IN MINING LAWS.

The session of the Quebec Legislature, which ended last month, closed without the introduction of the new mining law, which the Minister had in contemplation in the early part of the session. That this deferring of a new mines act is a wise measure, there can be little doubt. In the meantime the Hon. Mr. Jean Prevost, it is announced, will visit the principal mining districts of the province during the coming season, to make personal observation of the requirements of the licensees and prospectors under the existing act. It is understood that the Superintendent of Mines, Mr. J. Obalski, will shortly issue a leaflet, or pamphlet, upon the Department's construing of the present Act, in relation to the remote mineral districts which were discovered last year in Northern Quebec. The trip of Mr. Prévost to the new Chibogamoo country has been postponed from

May until August, when conditions will be better for the observation of how the existing law has been construed by the different parties now in this northern field.

MINING IN NOVA SCOTIA.

The annual report of the Department of Mines of Nova Scotia was recently submitted to the Legislature. As a whole, it was an encouraging one, though there was a diminution in the production of coal and gold.

The amount of coal raised during 1905 was 5,150,420 tons, as compared with 5,247,136 tons in the preceding year, a decrease of 196,750 tons. Gold was produced to the amount of 15,500 ounces, a gain of 1,325 ounces over the production of the year 1904. Two hundred and seventy-four thousand tons of iron ore were imported into Nova Scotia during the year. The province derived royalties from minerals to the amount of $613,811.00, gross, from which, however, must be deducted $41,732.00, which sum was paid as a bonus to the Cape Breton steel companies, on account of provincial coal consumed in the manufacture of iron and steel.

During 1905, coal to the amount of 4,475,284 tons was sold, a decrease of 69,325 tons, from the sales of the previous year. To extract this coal the services of 10,780 men were required, who put in an aggregate of 2,743,528 days labour.

OXYGEN GENERATORS FOR UNDERGROUND USE.

The rescue of the French miners at Courrières, by their German comrades from Westphalia, emphasizes the value of suitable apparatus for supplying oxygen to miners employed upon such work. The most efficient types supply sufficient air to enable a man to breathe for two hours, which is as long as any one engaged upon laborious work would probably be able to stand the strain. It is not good practice, however, for a man to endeavour to remain for such a length of time, and in some of the latest oxygen-suppliers a signal is given automatically by the machine at the end of three quarters of an hour. Those used at Courrières supplied oxygen automatically, and the air, after being exhaled, passed through two generators, which freed it from CO_2, and rendered it again fit to support life, when mixed with a further supply of oxygen. The generators contained specially prepared caustic potash, which did not generate as much heat as the ordinary commercial article, thus rendering a cooling chamber unnecessary. The apparatus which proved so efficient upon the occasion that we have mentioned was designed by Director Meyer, of the Hibernia and Shamrock mines, in Westphalia. It required no helmet, or face mask, which was a decided advantage, as the men had hard muscular work to meet before they could rescue their entoombed comrades.

THE SAN FRANCISCO DISASTER.

In the face of such a calamity as that which befell San Francisco on one April morning, one realizes man's impotence. Although less disastrous, as far as the loss of human life is concerned, it resembles the disaster which overtook St. Pierre in its far reaching devastation. In the course of a few hours the labour of years was wiped out. First came the wholesale destruction caused by one of the heaviest earthquakes shocks that has been experienced on this continent; then a conflagration started, that was not quenched until the greater part of the magnificent city of San Francisco lay in ashes.

One of the heaviest sufferers was our valued contemporary, the *Mining and Scientific Press.* Owing to the hour at which the disaster occurred, shortly after 5 a.m., the library and plant were destroyed without a chance of even a small portion being rescued.

The CANADIAN MINING REVIEW tenders its sincere condolence to Mr. T. A. Rickard and his coadjutors of the *Mining and Scientific Press.* We believe, however, that the *Press* will rise phœnix-like from its ashes, and that, eventually it will be able to date the beginning of a period of greater success from that dismal day when the end seemed to have come for San Francisco and its inhabitants. A paper that has earned the confidence and respect of its subscribers and patrons is as indistructable as anything well can be

MINING SCHOOLS.

In a recent issue of *Mines and Minerals*, Prof. A. H. Purdue published an article on Mining Schools. As this subject has lately received some attention in these columns, the following abstract of Prof. Purdue's article is re-produced.:—

"Each locality has its own peculiar mining problems, which will be quicker met and solved by engineering schools near at hand than by those distantly situated, for the reason that they are near and convenient and it will be to their intersets to develop the mining industry of the locality. There are doubtless many deposits of economic worth lying idle, which need only the incentive that would come from a near-by mining school to make them paying property. There are others being worked by antiquated methods, eking out a precarious existence, that a little intelligent direction, coming from the influence of a school whose duty it is to look after the mining interests of the locality, would put on a paying basis.

The elective system that prevails in practically all of our state universities permits those students who take their degrees in other lines of engineering, to elect such courses in mining as their time and preparation will permit of. At my own school though the courses in mining have been offered less than a year, certain ones of them have been elected by the best students in engineering. While such students cannot be sent out as mining engineers, the small knowledge of the subject thus acquired may prove of inestimable value to them and their employers in the future. Futhermore, we fully expect within the next few years, to discover several mining engineers by students in other engineering lines electing our courses. A large percentage of boys who enter college have engineering tendencies and enter the departments of civil, mechanical, and electrical engineering, having never heard of mining engineering. By electing courses in the latter many will find that it is more to their liking than the course taken up, and will make the change.

The courses in mining engineering are the only ones offered in our schools that lay sufficient stress upon the estimation of the cost of work and plants. An immense building brings in profit from rent. A railroad bridge pays for itself and is a source of profit to the company because of the line it completes for ready transportation. *But every dollar that is put into a mine for labour, material, or machinery, must come out of the mine, and enough in addition to pay a profit on the investment.* This necessitates a most careful investigation into the probable size of the ore body, the cost of working it, the facilities for transportation, the cost of fuel, the cost of the plant, and the hundred other things that naturally suggest themselves to the cautious manager. Such a course of training is valuable not only for the mining engineer, but would be most valuable to students in other lines, especially in civil engineering.

In no other field are intelligent business men so often imposed upon as in "wild-cat" mining schemes. Men with good business judgment in most things are often easily led into these "sucker traps." The general diffusion of mining knowledge that would come from a large number of good mining schools would do more than anything else to prevent the floating of these fake schemes.

Many mining schools in close proximity would act as a stimulus for each other, just as the multiplication of universities has acted in the field of general education. We can well imagine the conservatism and air of self-satisfaction that would prevail in our universities if there were but a few of them. Would not the same conservatism, self-satisfaction, and non-progressiveness pervade our mining schools if they should remain but few in number? Under such conditions, would they not be teaching methods long ago discarded by the wide-awake, progressive miner in practical work? Sharp competition will keep us all abreast of the times."

THE WORLD'S GOLD SUPPLY.

It is probable that when the records for the year 1906 shall have been made up, the gold production of the world will be found to have reached four hundred million dollars. The growth has been wonderfully rapid since 1890, when the production was but some 120 millions of dollars. Up to that time the increase had been steady, but during the following five years it became larger by an average yearly increase of about fourteen million dollars. During the last ten years this increase has been exceeded, so that the average yearly growth has been about twenty million dollars. A careful study of the gold mining industry almost forces the conclusion that this four hundred million dollar production will, at least, be maintained, and probably increased. It is believed that the stock of gold available for currency is increasing at the rate of a million dollars a day.

The effect of this flow of gold is attracting the attention of financiers throughout the world. An increase in the supplyof the precious metals naturally tends to increase the price of commodities by putting more purchasing power in the hands of individuals, and hence increasing the demand. Whether such increase will be directly proportionate to the increase of gold in circulation is, however, a question upon which opinion is divided. Most writers on economic subjects argue that, in general, wages will not be likely to increase with the same rapidity as the prices of material, and it is held that salaries are the last items to advance. Whether the great increase in gold production which the last decade has witnessed will be a blessing, or the reverse, is something upon which men will continue to differ until the future shall have given us the answer.

THE NEW ONTARIO MINERAL ACT.

The mining bill that has been introduced in the Ontario Legislature, by the Minister of Mines, the Hon. Frank Cochrane, is still under debate as we go to press. We are, therefore, unable to say what will or will not be the mining law of the province for the next twelve months. As originally drafted, the new mining bill seeks to substitute one uniform system of acquiring mineral lands, in place of the complicated methods now in force. There are to-day no less than four ways by which a man may obtain the right to mine in the Province of Ontario: he may either purchase the land outright, or he may lease it, or he may stake it out in a mining division, or he may stake it in land that is outside a mining division. The conditions as to prices and amount of work required have been found to be beyond the comprehension of many prospectors, which is, perhaps, not surprising, seeing that a man may be a very excellent prospector and yet possess little or no education.

The new bill proposes a uniform system, which is, briefly, as follows: In the first place a person desiring to hold mining lands must pay $10.00 to the Province of Ontario for a miner's license, which will be valid for one year; the province will be divided into mining divisions, and in each division a mining record office will be opened, provided the demand for such an office shall make itself felt; a claim will be limited to a square of 20 chains, with north, south, east and west boundaries; the claim must be recorded in the office of the mining division in which it is situated, and the discovery will be subject to the approval and inspection of the mining inspector or his representative; should the report be favourable, the prospector will be required to do a certain number of days work within a certain specified, or shorter, time; after which he may buy the land at either $2.50 or $3.00 an acre, according to its situation, and he will then have an indefeasible title, without further working conditions.

It appears to us that there are several points to which objection may possibly be taken. The revenue from mining licenses, while it will amount to a considerable sum, is not to our mind a good source of revenue. It is a hardship to a poor man to take out a license, and is a discouragement, whereas the prospector should be encouraged to follow, what must be in any case, an arduous, and may possibly prove to be an unremunerative pursuit.

A little consideration will show the vast opportunities for fraud and litigation, that are opened by the *insistence of an inspection previous to the acceptance of a location as valid.* It is quite possible that occasions may arise in which an honest difference of opinion shall exist between the prospector and the inspector as to what constitutes "valuable" mineral. A mineral may be valuable, under certain conditions, although it has no quotation in the markets of the world. It might, for instance, be required for experimental purposes. Would it not be better to accept the statement of the prospector, made under oath, that the claim he had discovered was worthy of working from his own point of view? If he deems quartz, for instance, as sufficiently valuable *to him* to justify the expenditure of his time according to the regulations, and to warrant the payment of the many fees required by law, why should our inspector, human, and therefore fallible, prevent him from acquiring that quartz if he is willing to spend his time and money?

Special regulations are proposed for the regions north of the Height of Land, where there are some reasons to believe that petroleum, natural gas, salt, lignite and other minerals may eventually be found, yet which would not oftentimes show on the surface. In those regions prospecting permits may be granted, good for one year and covering 640 acres, for $100.00. The holder will be required to spend $2.00 an acre in actual work in developing his claim, and, upon making a discovery, may demand a lease at a rental of $1.00 per acre, and an expenditure of $2.00 an acre in work. These regulations appear to have been well thought out, as it is desirable to encourage the prospecting of the more distant parts of the province, and inducements should be held out to those who are willing to face the difficulties and arduous labours incidental to the explorations of our northern territories.

There are many other provisions in the bill which we hope to comment upon in a future issue.

During the debate on the new bill the Hon. Frank Cochrane stated that a discovery of anthracite had been made north of the Height of Land. Such a rumor has been made before, and not once but many times, but it seems to be totally without foundation or endorsement by competent authority. The CANADIAN MINING REVIEW has taken pains to investigate this rumor, and from the best information it has been able to get it would appear that this so-called coal is an imperfect lignite, occurring in the rocks of the quaternary era that has been more or less hardened through the proximity of eruptives causing the evaporation of volatile matter, until it has much the appearance of an anthracite or of anthraxolite instead of the lignite which it really is.

The Superintendent of Mines for the Province of Quebec, Mr. J. B. Obalski, who has seen some of the reported discoveries, informs the REVIEW that it is an imperfect lignite, and not of an anthraxolitic character. The report made by Mr. J. M. Bell, who visited Northern Ontario some few years ago, indicated that the quantity of the substance, whatever it may be, is probably small, and that the quality is poor. The occurrence of this substance in formations as recent as that in which it is found makes it improbable that it will have any great commercial value.

THE TREATMENT OF TEMISKAMING LOW-GRADE ORES

By S. F. KIRKPATRICK, Professor of Metallurgy, Kingston.

The deposits of the Cobalt district consist, essentially, of narrow but well defined veins of smalite and niccolite in a matrix of calcite, the whole vein being usually impregnated with native antimonide and sulphide of silver.

The width of these veins varies from over 12 inches to a mere fraction of an inch, and the method of mining is to break away one wall as carefully as possible, then breaking down the vein matter on canvas or other suitable material. The ore being afterwards subjected to a judicious handpicking.

In the case of large veins, unfortunately rarely met with, a fair result may be secured in this way, but even then some of the vein material may find its way to the dump and losses may also occur through the wall rock adjacent to the vein carrying mineral. In the case of small veins much more difficulty is experienced in making a good separation, and in many cases these veins break up into small stringers, and the country rock may be very heavily charged with mineral that cannot well be recovered by handpicking.

This rock material may be of very considerable value, as in certain sections of the district the small veins are particularly rich in silver, often assaying from 2,000 to 5,000 ozs. per ton.

It was, therefore, with a view to treating the ore or waste rock left after handpicking the high grade ore, that a number of tests were conducted in the laboratories of the School of Mining at Kingston, of ore supplied by three of the principal mine owners of that district.

The ores treated assayed from 25 ozs. to 125 ozs. silver per ton. The commercial concentration of the lower grades of these ores by smelting is not simple, on account of their refractory nature and hence, the large amount of flux and fuel that would be required. Moreover the cost of building and operating a small plant (if the ores were treated on the ground) might be prohibitive; and if they were not so treated the freight charges would be important items.

The following methods of treatment were therefore investigated on a laboratory scale, and also in most cases on ton lots:—

I. AMALGAMATION AND CONCENTRATION. II. STRAIGHT CONCENTRATION. III. STRAIGHT CONCENTRATION WITH CYANIDING OF SANDS AND SLIMES.

A summary of the results obtained on four ores, given in approximate figures, may be of interest to the readers of the CANADIAN MINING REVIEW.

I. AMALGAMATION AND CONCENTRATION:—

The ores from the different properties, and even different grades of ore from the same property, showed a very considerable variation in the amount of silver they would yield to amalgamation. The ores were crushed, and treated in a silver amalgamation pan with mercury, with and without the addition of chemicals (salt and copper sulphate), and the residues were concentrated.

The results in a few cases were as follows:—

Ore No. I. assaying 87.0 ozs. silver per ton.
The silver recovered as bullion from the amalgam was of the total silver. 25%
The silver recovered in high grade concentrates was of the total silver. 45%
Total saving 70%

Ore No. II. assaying 60.0 ozs. silver per ton.
The silver recovered as bullion from the amalgam was of the total silver. 50%
The silver recovered in high grade concentrates was.... of the total silver. 25%
Total saving 75%

Ore No. III. assaying 122.0 ozs. silver per ton.
The silver recovered as bullion from the amalgam was of the total silver. 68%
The silver recovered in high grade concentrates was.... of the total silver. 12%
Total saving 80%

In every case, however, there was a heavy loss of mercury, and some difficulty was experienced in separating the heavy concentrates from the amalgam.

II. STRAIGHT CONCENTRATION:—

For these tests the ore was crushed in stamps or rolls, to from 20 to 40 mesh, and concentrated on a Wilfley table, giving the following results:—

Ore No. I. assaying 87.0 ozs. silver per ton.
The Silver saved in the concentrates assayed 1,200 ozs., and in the middles 500.0 ozs. Making 77% of total silver.

Ore No. II. assaying 60.0 ozs. silver per ton.
The silver saved in the concentrates assayed 1,200 ozs. and in the middles 300.0 ozs. Making 72% of total silver.

Ore No. IV. assaying 28.0 ozs. silver per ton.
The silver saved in the concentrates assayed 780 ozs., and in the middles 150 ozs. Making 55% of total silver.

These results showed that practically all the silver that could be recovered by amalgamation could be saved in the concentrates; of course, not in the form of bullion, but as a marketable product, with the advantage that the plant, required, could be erected and operated cheaply.

However, there is considerable loss of values, the greatest loss, as was expected is in the fines or slimes. The coarse tailings or sands from test I assayed and found to carry 14 ozs. silver, while the slimes assayed from 35.0 to 40.0 ozs.

Ore No. II. gave sands assaying 12.0 ozs., and slimes assaying 40.0 to 45.0 ozs.

Ore No. IV. gave sands assaying 10.0 ozs., and slimes assaying 25.0 to 30.0 ozs.

III. STRAIGHT CONCENTRATION WITH CYANIDING OF SANDS AND SLIMES.

We tested these products to get a further extraction, and obtained very satisfactory results with cyanide. In all cases from 60 to 75% of the silver values were extracted from the sands, or coarse tailings, with a cyanide consumption of from 1 5 to 3.0 lbs. per ton of ore, and the slimes when treated by agitation yielded from 80 to 90% of their silver, with a somewhat high consumption of cyanide, viz.: 5 to 10 lbs. per ton of ore.

The results obtained on the ores mentioned by the combined concentration and cyaniding of tailings were as follows:—

Ore No. I. assaying 87.0 ozs. per ton.

Silver saved in concentrates	77%	of total silver.
Silver recovered by cyaniding coarse tails	8%	of total silver.
Silver recovered by cyaniding slimes	10%	of total silver.
Total recovery of silver	95%	

Ore No. II. assaying 60 ozs. silver per ton.

Silver saved in concentrates	72%	of total silver.
Silver recovered by cyaniding coarser tails	10%	of total silver.
Silver recovered by cyaniding slimes	12%	of total silver.
Total recovery of silver	94%	

Ore No. IV. assaying 28.0 ozs. silver per ton.

Silver recovered in concentrates	55%	of total silver.
Silver recovered by cyaniding coarse tails	19%	of total silver.
Silver recovered by cyaniding slimes	18%	of total silver.
Total recovery of silver	92%	

Besides the silver value a considerable percentage of the nickel and cobalt would be recovered in the concentrates, and might be realized on, if the sale or treatment of the high grade ores of this district is successfully settled from the producers point of view.

The mill required for the treatment of these ores according to this latter process would consist of a crushing device such as a stamp battery, a set of riffle tables, and a sand and slimes cyanide plant.

The cost of treatment would vary with the size of the plant but would be reasonable, and, probably, allow of the profitable treatment of ores containing 15.0 ozs. or less silver.

A NEW MATTE SEPARATOR.*

By R. R. Hedley, Nelson, B.C.

The problem of most efficiently separating matte from slag in blast furnace work has occupied the attention of metallurgists with results varying very widely.

In copper matte smelting it is more or less simply a question of settling by gravity; while in lead smelting, with base ores, the problem becomes more complex. The day of the conical pot with a tap hole is past, and large rectangular forehearths are used. Many conditions prevail, making it impossible to produce a slag sufficiently free from silver to discard, and in such cases it is customary to save and re-smelt the shells which chill rapidly on the pot and which carry a large proportion of the silver. In copper smelting, Nicholls and James of Swansea recommend a small reverberatory with independent fire-box, in which the slag is reheated, and Mr. Rhodes of the Arkansas Valley Works was using a large reverberatory in "97, into which the matte and slag were poured as taken from the blast furnace in slag pots. Many attempts have been made to take the matte direct from the furnace and thus avoid the intermixing with slag, but so far as I know these have not been economically successful.

I propose to describe the device, successfully used for the past six months, in the Lead Smelting Works of the Hall Mining & Smelting Company, Ltd. at Nelson, invented and patented by Mr. Henry Harris, A.R.S.M.; and, if possible, to point out concisely and clearly its manifold and manifest advantages. First of all, it is manifest that a fairly complete separation of matte from slag takes place within the furnace where a very high heat is developed, and that if this separation can be maintained without the furnace, a vast advantage is gained over letting both matte and slag flow together to any receptacle where they must be again separated by gravity at a lower heat, or by reheating.

*A paper read at the annual meeting of the Canadian Mining Institute, Quebec, March, 1906.

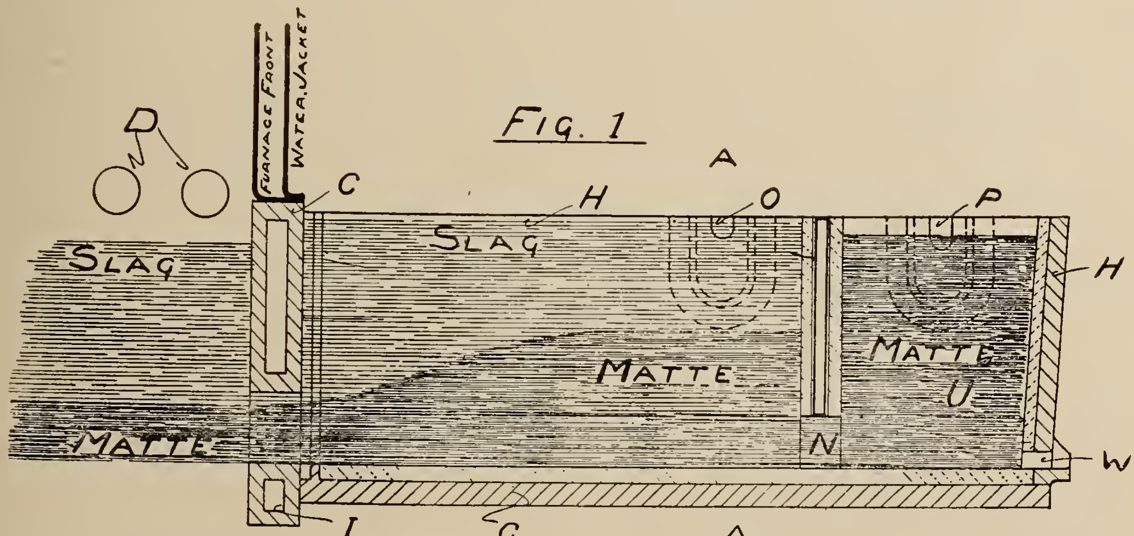


Fig. 2

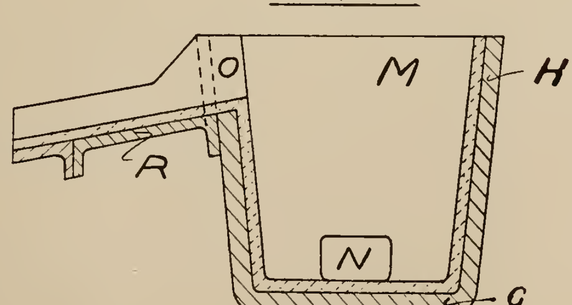
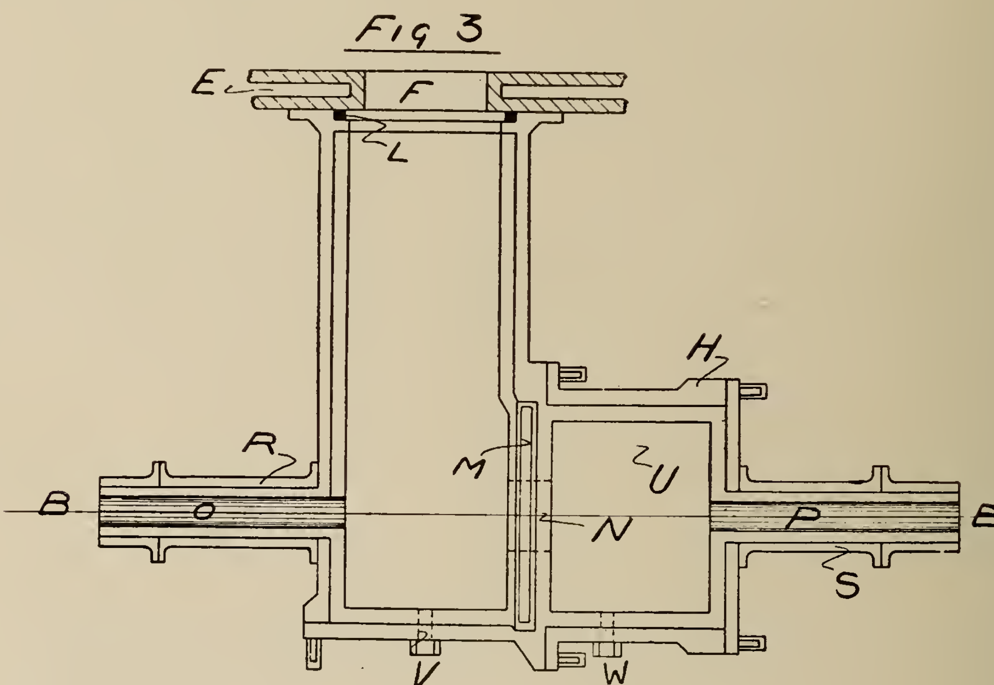


Fig. 1—Diagram showing manner of operation. Fig. 2—Cross-section on the line A A Fig. 1.

The Herreshoff forehearth has its greatest advantage from the application of this principle, carrying the slag overflow well above the tap hole of the furnace, and periodically tapping matte as it accumulates. In the early 80's, John L. Thomson, Superintendent of the Orford Works of New Jersey, adopted a form of forehearth, now known as the Orford syphon-tap, whereby on tapping the furnace a constant flow of matte and slag is maintained whilst no attempt is made to maintain the separation existing in the furnace. This is very successfully used for copper smelting where the matte fall is heavy, and I have used it on lead furnaces with satisfaction. This is simply a rectangular settling box with a division wall having an aperture at the bottom through which matte is permitted to flow, and rise in the second compartment, whence it flows at a level slightly lower than that of slag in the first compartment. In lead smelting, with ores such as the metallurgist of to-day is called on to treat, one has not only to contend with the prills or granules of matte, so difficult to separate completely from the slag when both flow intermittently from the furnace, but there is also that agglomeration, hardly matte, which chills so readily, and rapidly builds up the settler, necessitating so frequent change and such labour to break up; and again that elusive zinc sulphide which declines to settle, but floats gaily, carrying its quota of silver into the slag flume.

It was after enlarging our forehearths, using a secondary conical pot, and even a third, improvising an Orford syphon-tap, etc. that Mr. Harris thought out the device now in use and giving excellent satisfaction. It is patented under the name of the Harris Distributor, as it distributes the matte and slag already separated in the furnace. This distributor combines the essential principles of the Herreshoff forehearth and the Orford syphon-tap, improving on the former in that its first compartment is virtually a continuation of the surface of the furnace crucible, having a free flow through an orifice 10 inches long by 5 inches high instead of connected therewith by a small tap hole. I can best describe this apparatus by quoting from Mr. Harris as follows:—



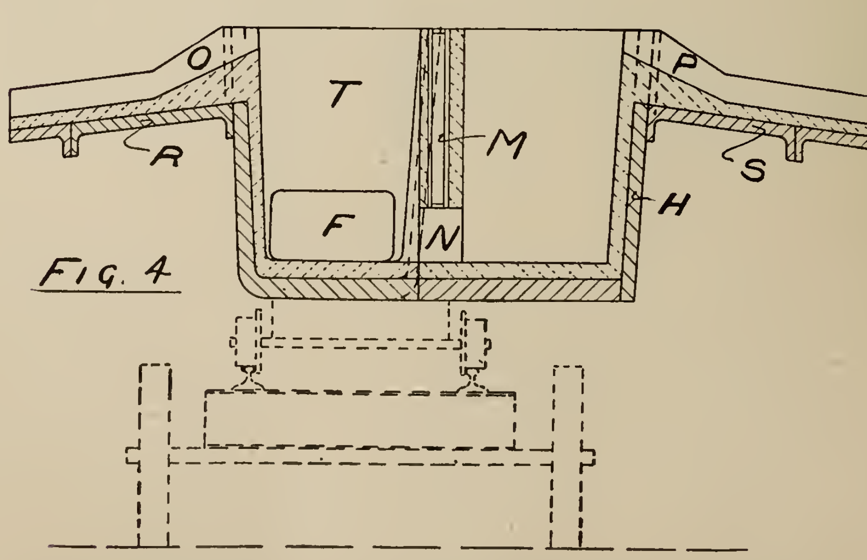


Fig. 3—Plan of Apparatus. Fig. 4—Vertical Section on the line B B, Fig. 3.

"It consists of an L shaped cast iron box about 30 "inches long, lined with tile or water jacketted to "suit conditions which is placed in free communica- "tion with the tap hole of the furnace, which should "be as wide as possible. The walls are deep enough "to afford a sufficient head to retain the amount of "slag and matte desired in the furnace. Placed in "this box at right angles to the face of the tap jacket "is a water jacket partition below which is an aper- "ture a few inches in height and which serves to "laterally divert the matte. Referring to the sketches:

"Fig. 1, is merely a diagram showing its manner of "operation.

"Fig. 2, is a cross section on the line AA in Fig. 1.

"Fig. 3, shows a plan of the actual apparatus.

"Fig. 4, is a vertical section on the line BB in Fig. 3.

"The manner of operation is as follows:—

"The apparatus is pressed closely against the tap "jacket E of the furnace, with its bottom on a level "with the bottom of the tap hole F.

"When the furnace is in full operation the matte "and slag will be maintained within the furnace at "levels corresponding to the head afforded by the "height of the slag and matte overflows O. & P.

"The slag from the double stream flowing from the "furnace will be arrested by the water jacket barriers "M and will be retained in the first division T to over- "flow at O, whilst the matte will flow through the space "N into the second division U and rise until its head "balances those of the matte and slag in the first "division of the box or the matte slag and blast pres- "sure in the furnace and overflow at P. It will thus "be seen that the levels of matte and slag in the furnace "will depend upon the weight of blast and the height "of the overflows O & P which may be varied con- "siderably at the will of the furnaceman.

"Its operation requires but little attention or skill, "and it will run for two or three weeks without change "which is quickly effected, the apparatus being mount- "ed on small wheels which run on rails on a truck "placed at a height corresponding to two short rails "at the furnace.

"It is not bolted in any way to the furnace, the "only connection necessary being made by tamping a "small quantity of fire clay in the groove L which when filled with slag, which chills between the surface "of the jacket and the flange, makes an extremely "efficient seal under the most stringent conditions.

"The tap hole V is provided to tap out any small "quantity of lead which may accumulate, and also "for tapping out the fluid contents of the furnace when "necessary.

"Where the production of matte falls extremely "low, the operator does not attempt a continuous "flow of matte for any length of time but builds up "the level of the matte overflow reducing it at regular "intervals. The oscillation of the contents of the "box due to the blast, prevents in this design the "solidification of the matte even when it is allowed to "stand for a reasonable time. Should however the "matte in the second division U become solidified, "it is easily removed without interfering in the least "with operation of the furnace."

Naturally, some time was occupied in perfecting this device and in becoming familiar with its operation, but it is now a recognized adjunct of the furnace, and the advantages gained by its use, in comparison with the discarded cumbersome settlers or forehearths, may be summarized briefly:—a better saving of lead and silver values in slags; a more perfect equilibrium within the furnace, conducing to more perfect metallurgical work and less tendency to irregularities producing troublesome crusts and accretions; less time lost in changing settlers; a saving of labour in handling the same and preparing the contents for resmelting; and a saving in iron and steel tools, as well as matte pots.

THE REVISION OF THE MINES ACT OF ONTARIO*

By J. M. Clark, K.C., Toronto.

Many resolutions have been passed and numerous recommendations made with reference to the revision of the Mines Act which is to be undertaken at the next session of the Ontario Legislature. These resolutions and recommendations have been varied, but it is noteworthy that at almost every meeting at which the Ontario Mining Law was discussed there was a demand for a mining law to be enacted by the Legislature and to be applicable to the whole of the Province. This demand is wise and fully justified. Sir Frederick Pollock has well said that the criteria of just laws in a civilized community are generality, equality and certainty, and few men are more competent to speak on the subject.

A good mining law must satisfy these three tests. It should be steadily kept in mind that our mining laws, like other laws, should be made by our legislatures and parliaments after full discussion by the representatives of the people. The function of a government and its officials should be to carry into effect the laws so made. The distinction between the law making powers of the legislature and the executive and administrative powers of the government is too often ignored. In view of the unanimity of the demand for a uniform mining law, it is to be hoped that in the interests of the mining industry a stable and well considered statute will be passed by the Ontario Legislature which shall not be subject to sudden alteration by Orders-in-Council.

The rights of explorers and prospectors should be clearly and distinctly defined, and also what has to be done to protect any discoveries they may chance to make. The mineral areas of Ontario have largely to be yet explored, and this will not be thoroughly done unless the pioneers are certain of protection and justice. The conditions upon which mining locations or claims can be held should also be clearly and plainly set forth.

It is for the Legislature to say what these conditions shall be, and for the Government to enforce the enactment of the Legislature.

In framing such a law for submission to the Legislature, the Government have many difficult questions to consider, many complicated problems to solve. The Government and the Legislature have to consider not only the prospector and discoverer, but likewise the miner and the investor in mining enterprises, and also the interests of other industries, such as, for instance, the lumbering industry, and of the public. The history of mining development in this Province has to be carefully considered, and it may be taken for granted that the best results will be obtained by making the necessary amendments and modifications of our existing legislation rather than by attempting an entirely new Act, although a new Act might easily be drawn that would be more perfect theoretically and more rigidly logical. The practical results of drastic and violent changes in our laws do not warrant the risks of such an experiment with our mining Act.

The main object is the development of our mining industry, which is of increasingly great importance.

*A paper read at the annual meeting of the Canadian Mining Institute, Quebec, March, 1906.

If this development is to be as great as it should be, there must be certainty and stability in our mining laws.

The history of our legislation shows that suggestion of gaining revenue by the imposition of royalties is a most unwise one.

Twice already has a system of royalties been introduced in this Province, and each time the results have been so disastrous that the royalties so imposed have been abandoned and repealed. There seems no doubt that like causes would again produce like effects. No one suggests that the mining industry should not bear its fair share of necessary provincial taxation; but no special or arbitrary burdens should be placed on it.

GENETIC RELATIONS OF SOME NICKEL-COPPER ORES.*

By Charles W. Dickson, M.A., Ph. D., School of Mining, Kingston.

Introduction.

Before discussing the ore-deposits of St. Stephen, and Sohland in particular, it might be well to briefly review the geological relations of nickel ores, in general. Economically we have to deal with the following classes of Deposits.

(1) Compounds with arsenic, (more rarely antimony,) or with arsenic and sulphur.

(2) Sulphur compounds, including pyrrhotites, and pyrites.

(3) Oxidised compounds, mostly silicates related to serpentine.

Nickel is universally recognized as an associate of pyyrhotite. But it is also well known that in different pyrrhotites the percentage of nickel varies widely. And on this basis, pyrrhotites may be subdivided into two main classes, and this classification is intimately connected with the geological relations of the sulphides.

(1) Pyrrhotite occurs with more or less chalcopyrite and pyrite, as lenses in *acidic gneisses and schists*. These lenticular masses nearly always conform to the foliation of the gneisses, and are often repeated and connected by leaner zones, after the nature of the so-called "fahlbands". Such deposits are of world wide distribution, but the pyrrhotite is *always low in nickel*, seldom containing more than 0.5, and generally less than 0.25. per cent.

(2) The second class is also widely distributed, and from an economic standpoint, calls for special attention. These deposits are also lenticular in shape, but are associated with *basic igneous rocks*, usually of the gabbro type, or their metamorphic equivalents. There is always more or less chalcopyrite and pyrite present, and at times rarer minerals, and the characteristic minerals of the basic rock are always intimately mixed through the prevailing sulphides. Nickel is almost invariably present in the pyrrhotite, at times up to 10 per cent. or more, but on an average, (e.g. in Sudbury), 2 to 4 per cent.

To the latter class of pyrrhotites, the St. Stephen deposits belong.

Many writers in r cent years have attributed a direct igneous origin to this class of pyrrhotites. The sulphides are regarded as original rock constituents, and the theory is that they crystallized, from the cooling magma, in their present position, by a "magmatic segregation."

*A paper read at the annual meeting of the Canadian Mining Institute, Quebec, March, 1906.

A thorough investigation of the Sudbury deposits has led me to the conclusion, that this theory of a direct magmatic segregation is untenable. This must, however, not be taken to imply, that the sulphides may not have been, to a large extent, original constituents of the basic magma. Also there may have been a partial concentration, during the cooling of this magma. But from the studies of the Sudbury and St. Stephen ores, there seems to be only one explanation possible, as to their present position. Namely that the deposits are largely secondary replacements along more or less crushed and faulted zones, by means of circulating solutions containing ore, which has been deposited by a metasomatic interchange, with the rock minerals; that is, that the main concentration of the ore, as seen at present, is of a secondary nature, *after the solidification of the magma*, and is not an original direct segregation from the cooling, but still molten magma.

The study of a somewhat similar deposit near Sohland, Germany, has led Prof. Beck, and myself to a similar conclusion in this case also.

As work has been discontinued for the present at St. Stephen, it was impossible to gain access to the mines. I was however furnished with material through the kindness of Messrs. W. K. and A. D. Ganong, of St. Stephen, which has proved amply sufficient for the present investigations. On the property from which these samples were taken, two shafts have been sunk, to the depth of 125 feet, and 80 feet respectively. Further prospecting has been done with a diamond drill, and though it is difficult to get exact information, I have been informed that a body of solid ore, 18 feet thick has been located.

St. Stephen, N.B.

While the nickel-copper deposits of St. Stephen have not as yet assumed the importance of producing mines, they are of more than passing interest. Aside from their possible economic value, they supply us with a great deal of information, which throws light on the genetic relations of this class of sulphide ores.

Mr. H. P. Brummel briefly sums up the geological relations of the deposits*, and Prof. L. W. Bailey gives us some further particulars in a later report.**

The Deposits.

Throughout the country north of St. Stephen, are large areas of diorite, with which are associated, more or less extensive deposits of pyrrhotite, and chalcopyrite, the former carrying nickel. The pyrrhotite masses are almost invariably capped by a gossan resulting from the oxidation of the sulphides. The rocks of the entire district consist of coarse and fine grained diabases, and diorites. They show the effects of severe metamorphism, and are often slickensided, and highly charged with sulphides in the vicinity of the ore-bodies.

Attention was first drawn to these deposits after the discovery of similar ores near Sudbury, and analyses showed that the St. Stephen pyrrhotites carried a small percentage of nickel. Numbers of test pits were sunk, showing the wide distribution of the pyrrhotite, and steps were taken to determine their value. Some of the ore bodies proved quite extensive, but the percentage of nickel was low and irregular, generally averaging 0.75 to 2%. In many cases only traces were found, though some samples showed as much as 4%.

*Geol. Sur. of Can., vol. V, new series, 1890-'91, p. 112 S.S.
**Geol. Sur. of Can., vol. X, new series, 1897, p. 27 M.

In 1897 Prof. Bailey made a careful examination of some of the more important localities, and calls attention to some of the principal features of the deposits. Compared with Sudbury, they show many features of similarity. (1) The St. Stephen beds like those of Sudbury, consist of basic intrusives, as diorite and diabase, with probably gabbro, and norite, associated with heavy beds of quartzite. (2) As at Sudbury the pyrrhotite would seem to be a normal constituent of the dioritic rock, and not an intrusion into the latter. (3) The St. Stephen rocks like those of Sudbury are referable to the Huronian system, and were probably formed under like conditions. On the other hand the average percentage of nickel in the St. Stephen ore, is much smaller than in Sudbury.

Nature of the Ore.

The St. Stephen ore consists of prevailing pyrrhotite with chalcopyrite and a very subordinate amount of pyrite. Through the ore are also small grains of magnetite. The magnetite does not however, so far as I have observed, occur in any considerable masses, but is present simply as an original residual, accessory of the enclosing rock. The pyrrhotite is nearly always finely granular and compact. At times it is nearly pure, without chalcopyrite, and having only isolated grains of silicates, as impurity. But these masses of pure ore are never extensive, and seem to be of comparatively local development. The pyrrhotite is mixed with more or less of the rock silicates, and also contains chalcopyrite. The amount of rocky inclusions varies considerably, as is the rule in such deposits, and in places may equal or exceed the sulphides. The chalcopyrite seems to be irregularly distributed. It seldom occurs in considerable masses, in any degree of purity, but is often closely associated with pyrrhotite, especially where the latter is mixed with a considerable amount of rock.

The relation of the chalcopyrite to the pyrrhotite is very interesting and significant. A number ot polished sections of the mixed ore were made, and in all of them the same phenomena were noted. The ore-rock is traversed in various directions by small parting planes and fracture zones. These are apparently the result of a dynamic movement which shattered the rock to a considerable extent. The parting planes do not seem to be confined to any one part of the rock, and traverse both pyrrhotite and rock proper. But they are *most apparent along certain lines where large phenocrysts of feldspar are abundant.* Also in connection with the feldspar, the development of chalcopyrite is most pronounced. The chalcopyrite extends along these lines of weakness in the form of veins, often terminated abruptly against the side of a comparatively fresh feldspar crystal, and ramifying irregularly, between the neighboring minerals, in a network of fine veinlets. In cases where a feldspar crystal has been shattered, and more or less decomposed, the chalcopyrite can be seen, penetrating it in all directions, along the cleavages and partings, in the form of delicate apophyses.

The conclusions to be drawn from these relations are very significant. That the chalcopyrite is a *later introduction* is shown conclusively, and this is an important fact in considering the paragenesis of the ore. It is evident that a dynamic movement has taken place *after* the formation of the principal body of the ore, namely the pyrrhotite. And along these parting planes, due to the dynamic effect, solutions bearing the copper sulphide, have circulated, with the foregoing result.

The conclusions are important in helping to explain certain phenomena of other deposits. Prof. Beck has come to a very similar conclusion with reference to the Sohland deposits, where chalcopyrite is often found along planes of weakness and shear planes.

Already for Sudbury a similar idea was advanced, but here the relations are masked to a large extent by the massive nature of the ore. But with the additional evidence offered by Sohland and St. Stephen, it grows almost to a certainty, that the relations of the chalcopyrite to the pyrrhotite can be explained in the same way for Sudbury.*

Further proofs that the ore-bearing rocks have been involved in a process of dynamic metamorphism are not wanting. The rock has been more or less shattered and brecciated. and numerous cracks resembling faulting planes are present. The minerals in the neighborhood of these seams are often completely granulated and show a marked undulatory extinction. These relations are brought out still more clearly by the microscopical examination. The movement does not seem to have been on an extensive scale however, and has resulted in a brecciation of the minerals themselves, rather than of the rock as a whole. The force has no doubt acted while the rocks, now exposed, were under a considerable load, and the minerals have readjusted themselves, in a somewhat plastic condition, so that their continuity is as a rule preserved. This resulted in the formation of lines of weakness in certain directions, and a somewhat gneissoid structure of the rock, accompanied by a granulation of the minerals.

Besides this, other rocks in the immediate vicinity, show very definite results of movement, which has developed a slickensided structure, along the planes of which the rock parts easily.

The ore-rock itself exhibits a number of minor varieties. That most intimately associated with the ore, is a rather coarse grained variety of gabbro, shading to diabase. It is characterized by the presence of rather large feldspar individuals, often drawn out and compressed. The feldspar as well as the other minerals are in an advanced stage of alteration, especially where ore is developed.

Another variety, only slightly impregnated with ore, is much finer grained and fresher. In appearance the rocks resemble gabbro, and will be more minutely described microscopically.

Microscopical Structure of the Ore.

The method of examination employed is practically similar to that used for the Sudbury deposits. The study of the microscopical relations of the ore and ore-bearing rocks, affords the surest means of determining the true nature and origin of this class of ore-bodies. Taken in connection with the evidence afforded by the megascopic relations, the results have proven most successful, in this case, as well as for Sudbury, in solving the problem of the origin of the deposits.

A large number of thin sections have been examined, including pure ore, and ore associated with varying amounts of rock, so that the results can be taken as representative of the entire deposit.

(1) Specimens of a medium grained, holocrystalline, hypidiomorphic granular rock, carrying a small amount of ore.

The rock is very compact and even grained, of a prevailing dark grey color, with lighter spots of feldspar, and often shows the slickensided structure mentioned above.

*See page 59 reprint "The Ore Deposits of Sudbury, Ontario, Trans. Am. Inst. of Min. Eng., 1903.

From the general mineralogical composition, the rock might be considered as an olivine-free gabbro. But from the prevalence of the ophitic structure, it must be classed as a transition form between a gabbro proper and a diabase. The basic nature of the feldspar however, as well as the nature of the inclusions, and the alteration products, belong more typically to a gabbro, than to a diabase.

Under the microscope the rock is seen to be made up largely of plagioclase feldspar, pyroxene, hornblende, and chlorite. Besides these minerals, there are small amounts of brown mica, apatite, quartz, magnetite, and secondary sulphides in varying amount.

The *feldspar* is as a rule fairly fresh, and nearly always builds sharply bounded crystals, about 2 to 4 times as long as broad. With reference to the pyroxene they are idiomorphic. The crystallization of the feldspar has apparently begun before that of the pyroxene, and extended through it, so that the feldspars appear to lie in a cement of pyroxene. (See Fig. 6.)

Twinning according to the albite law is universal, and at times is combined with a carlsbad twinning. Measurements of the extinction angle range up to 32 and 34 deg., showing that the feldspar belongs to the basic end of the group, that is, bytownite or anorthite. In the feldspar crystals themselves, are numerous, zonally arranged needles, of a highly refracting mineral, whose exact nature could not be determined, but which is probably rutile. There are also inclusions of a secondary nature, where alteration has begun.

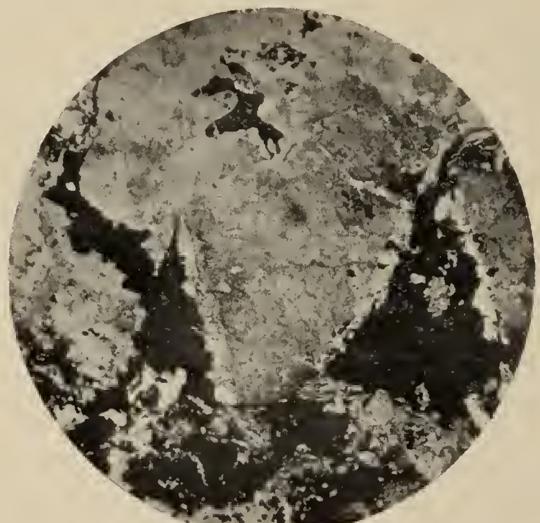


Fig. 1.—Ore rock showing pyrrhotite replacing feldspar, and hornblende along shearing planes, which can be traced through the section. The rock minerals in the vicinity of the ore are largely altered to aggregates of decomposed feldspar, fibrous, green hornblende and chlorite. There are a few grains of colorless epidote, and a small amount of fresh, regenerated feldspar.—Magnified about 70 diameters.

These consist of small centers, of highly refracting particles, of a saussuritic nature. The feldspar resists alteration much better than the other minerals.

The prevailing pyroxene is most closely related to diallage, but is peculiar in some respects. A few grains of other pyroxenes, resembling diopside, and an orthorhombic variety, were also noticed, but the amount is very subordinate. The diallage as stated is without crystal boundaries, and forms a cement for the feldspar. The color is light brown, often with a tinge of violet, (indicating titanium). Pleochroism is very faint, and only observable as changes of shade. Besides the ordinary cleavages, which are well developed, the pyroxene is characterized, in that it possesses the peculiarity of a decided *fibrous structure parallel to the base*. The maximum extinction angle is high, corresponding to diallage, and reaches 39 to 40 deg. Regular intergrowths with diopside as well as with brown hornblende, are frequently noticed.

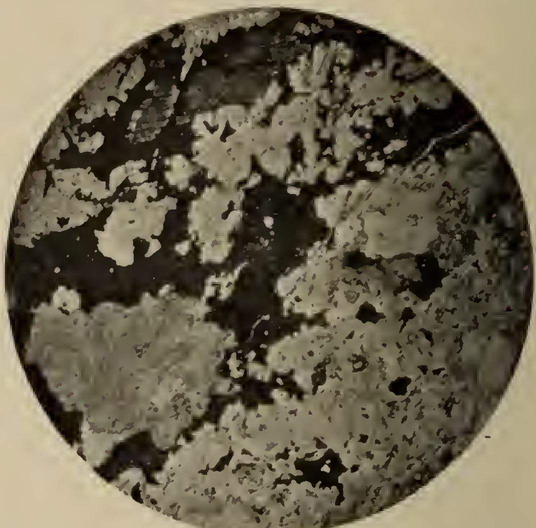


Fig. 2.—Ore-rock with considerable calcite, showing the etched borders of the epidote and hornblende, and ore along the cleavages and between the grains. A fragment of brown hornblende, partly bleached, and altered, is cut entirely in two by the ore, which is also seen along its cleavage planes.—Magnified about 70 diameters.

The pyroxene is always in a more or less advanced stage of alteration, which makes its exact determination at times difficult. In most cases it is filled with fine dust-like inclusions, of both a primary and secondary nature. The latter are highly polarizing and consist of calcite and epidote, with more or less of a talcose mineral. Again it is often pierced with numerous needles of a secondary green hornblende, or chlorite. In a further stage, a green fibrous horn-

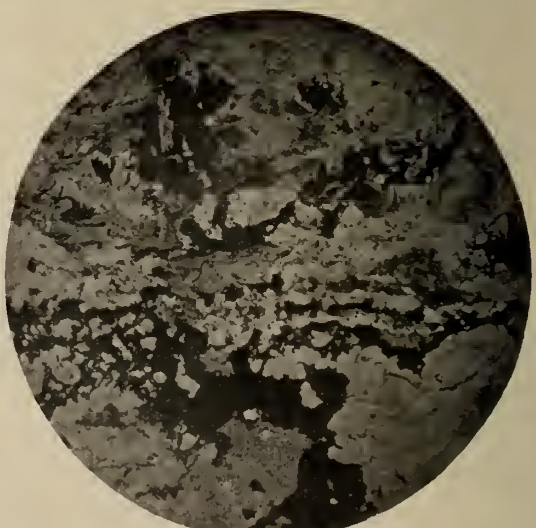


Fig. 3.—Ore-rock, with part of an irregular veinlet of sulphides, along a line of weakness, where the rock is much crushed and decomposed. Residues of epidote, pyroxene, etc., can be seen entirely surrounded by ore. The epidote is finely granulated, and shows the effects of a severe dynamic strain. It is also filled with decomposition products, and associated with calcite, while chlorite is also abundant. Small amounts of altered dornblende and diallage also remain, partly replaced by ore. Magnified about 65 diameters.

blende, resembling actinolite, results, commencing from the periphery and along cleavages. As the alteration proceeds still further, chlorite, (var. pennine,) results, which may color the surrounding minerals green for a considerable distance.

Besides the secondary green hornblende mentioned, a brown variety is quite abundant. In some cases it is undoubtedly primary, but may in part be derived from the diallage. The advanced decomposition of the dark silicates, often makes it difficult to decide which is primary and which is not. This hornblende is usually of a dark color, with a violet shade, when fresh, and the pleochroism is strong. A greenish color or bleaching, usually results as the first stage of chemical alteration, and it gradually passes to fibrous aggregates of green secondary hornblende, and finally to chlorite.

The small amount of quartz is apparently primary. It is mostly clear and fresh, but also contains small needle-like inclusions, and infiltrated hornblende. The amounts of apatite and brown mica are very subordinate, and the latter is evidently secondary. Magnetite as a primary accessory constituent, is in quite large amount, and in some cases the sulphides are important.

Relation of Sulphides.

In contrast to the primary magnetite, the relation of the sulphides to the rock minerals is striking. Besides the primary magnetite, however, is a small amount, in fine-dust like particles, which results from the alteration of pyroxene and hornblende. The *primary* magnetite is always in the form of more or less rounded grains, enclosed in the dark silicates and sulphides, with unaltered contours.

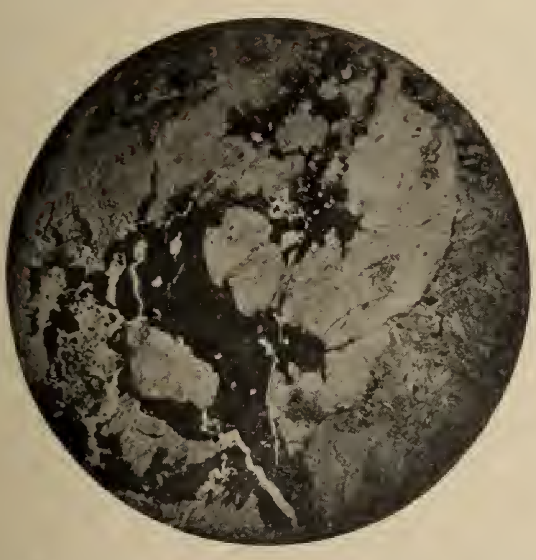


Fig. 4.—Ore-rock, showing part of a veinlet of chalcopyrite chalcopyrite and pyrrhotite, which extends across the section along a line of shearing. The epidote and pyroxene are granulated and strained by pressure, showing undulatory extinction and a curved cleavage. The sulphides replace the pyroxene and epidote in a typical manner, etching the borders of the grains and extending along the cleavage planes.—Magnified about 70 diameters.

The ore which is almost exclusively pyrrhotite, is largely confined to the neighborhood of the dark silicates. It is possible that it has in part, been formed in place, by sulphur-bearing waters reacting on the iron, resulting from the alteration of the silicates. But whether the sulphides originated in this way, or were introduced from external sources, they are certainly secondary.

Where the hornblende and peroxene are still fresh and compact, the sulphides form a border around them, sharply defined by the edge of the mineral. But as the rock minerals become more altered and fibrous, the change proceeds further. At first, fine threads of sulphides insinuate themselves, between the fibres and along the cleavages, and may finally replace the whole silicate fragment. This often results in a more or less complete pseudomorph, but the change has gone on so delicately, that the sulphides

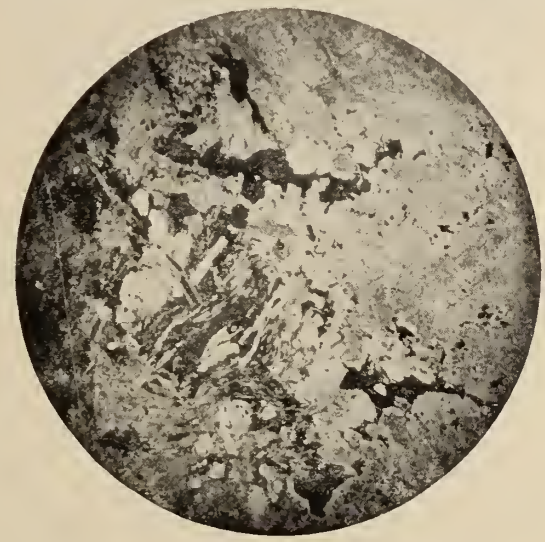


Fig. 5.—Ore-rock, showing decomposed feldspar, with secondary hornblende and chlorite. About the centre can be seen an area of secondary, greenish, fibrous hornblende, which is largely replaced by ore, but in such a manner that the sulphides retain the orignial fibrous structure of the hornblende.—Magnified about 50 diameters.

preserve the *fibrous strueture* of the replaced mineral. This change of course, is very often incomplete, but the principle is always the same, and the *greatest development of sulphides is always found, where the alteration of the roek minerals* is most prominent.

(2) Rock strongly impregnated with ore, taken from the shaft, at a depth of 30 feet.

The rock itself is a diabase gabbro, with a hypidiomorphic-granular structure; in places rather coarse grained, and with prominent feldspar crystals.

A somewhat gneissoid structure, and slickensided surfaces have been developed by dynamic stresses.

The principal constituents are: feldspar, epidote, pyroxene, hornblende, and chlorite, with apatite, magnetite, calcite, etc., as accessories.

The feldspar is a basic plagioclase, approaching labradorite, or bytownite, and when not too much altered, shows a typical albite twinning. As a rule the feldspar is in an advanced stage of decomposition, and the twinning structure may be entirely obliterated. It builds irregular grains and aggregates, but often presents good crystal outlines, in a ground-mass of pyroxene or hornblende, giving the section somewhat the appearance of a diabase. Most of the feldspar has passed to indistinct aggregates of highly polarizing secondary products, consisting of calcite, sericite, or saussurite, and colored greenish by migrated hornblende and chlorite. Fig. 1 shows such an altered feldspar individual. Around the edge of the altered grains can be seen a rim of clear "*regenerated*" feldspar, in optical continuation with the old.

One of the most prominent minerals is a clear variety of epidote, characterized by the fact that the plane of the optic axes is at right angles to the cleavage. It is always in the form of irregular grains, sometimes

Fig 6.—Comparatively fresh ore-rock, showing typical ophitic structure, with feldspar in excess, in a groundmass of diallage. Crossed nicols.—Magnified about 50 diameters.

quite large, with no approach to crystal form. Seen in ordinary light, the grains appear as one individual (See Figs. 2 and 4). But between crossed nicols, the mineral has a marked undulatory extinction, and the mass breaks up into a mosaic of small and irregularly oriented grains, showing the effect of severe crushing. The epidote is usually quite fresh, but where most crushed and granulated, it is intergrown with secondary hornblende and chlorite. (Fig. 3). The epidote stands in very close relation to the sulphides, and the origin of both is no doubt closely connected with the same metamorphic processes.

The chief pyroxene is diallage. It is usually in rather irregular plates, without crystal outline, and shows a more or less fibrous cleavage. A regular intergrowth with hornblende is common. (See Fig. 4). The diallage is in various stages of alteration, first changing to secondary hornblende, and then to the variety of chlorite, pennine. The alteration takes place along the cleavages, and from various centres. The brown color is bleached, the double refraction becomes weaker, and a fibrous aggregate of hornblende and chlorite results.

The next most important mineral is the brown hornblende. This is evidently primary, and shows the usual pleochroism and cleavage. In part it is quite fresh, but more often it is altered to secondary actinolitic and tremolitic hornblende, and finally to chlorite. (Hornblende, in various stages of alteration are seen in Figs. 1 and 2). The secondary green hornblende, which is very abundant, is derived from both the pyroxene and hornblende. It is partly in the form of irregular grains but more frequently in tufts, and fibrous masses, irregularly oriented. A further alteration ends in a confused mass of hornblende fibres and pennine, mixed with indefinite secondary products.

Calcite as a secondary product is often quite prominent, especially in connection with the ore and epidote. (Fig. 2). The usual accessory minerals of gabbro occur in small quantities, but are not important.

Relations of the Ore.

The relation of the sulphides to the rock minerals is very characteristic. In all the sections belonging to this type of rock described above, they are identical, and fully demonstrate the secondary nature of the ore.

That the rock has been subjected to the forces of dynamic metamorphism, is borne out by the microscopical examination. The constituent minerals are brecciated and deformed, and the rock is crossed by many small breaks and cracks, both of a megascopic and microscopic nature. Along these lines of weakness, the effects of pressure and strain are most apparent. The granulation and alteration of the minerals is here most pronounced, and ore is always present in the form of veinlets, following the direction of the fracture planes. Under these circumstances, calcite and epidote are usually abundant, and from this it may be inferred that the ore has been formed in part later, by means of circulating waters, as well as during the actual metamorphism. Such veinlets are shown in Figs. 2 and 3; very typically in the latter. It is not likely that actual open fissures resulted, or ever existed. The effect of the dynamic stresses was to prepare a line of least resistance, along which the ore-bearing solutions found their way, and left the minerals in such a condition that they could be easily replaced. Fig. 3 shows this distinctly. The ore has replaced the brecciated minerals along such a fracture plane, and left small residual grains unreplaced and *surrounded by ore*. The veinlets often cross the entire section, but are never uniform. They expand and contract, and send out ramifications among the surrounding minerals, in a very typical way, and replace them to a considerable extent.

In connection with the epidote also, the sulphides are prominent. They form an irregular network, between the grains, which make up the larger aggregates. They force their way between the grains, etching them, and finally isolating them from the main mass. They find their way along cleavage cracks, and planes of weakness, so that the grains finally appear in a matrix of sulphides, which holds them together. (See Figs. 2 and 4).

Replacement has gone on most actively in connection with the epidote, pyroxenes and hornblende, and their alteration products. But where the feldspar has been crushed and broken, it is also attacked and is very frequently seamed with sulphides, though to a smaller extent than the bisilicates.

The rock contains a considerable amount of magnetite, of a primary nature, but as before, it presents a strong contrast to the sulphides. It is in the form of rounded or elliptical grains, and never has the numerous vein-like ramifications, which characterize the latter.

(3). A third variety of ore-rock is found in the shaft. It belongs to the gabbro type, but is much lighter in color than the others, owing to the prominence of large individuals of a whitish feldspar. Taken as a whole, the rock is very similar to the last, but with a number of interesting variations. Alteration has reached an advanced stage; the feldspars are composed of turbid masses of secondary products, and both hornblende and pyroxene are almost completely changed to secondary hornblende and chlorite. The epidote which was so prominent in the other variety is here lacking, and diallage cannot be identified with certainty. It is evident that a great deal of the secondary hornblende was derived from original pyroxene, but this could not be directly proved.

The most interesting mineral is the feldspar. Along its cleavages, and bordering the altered mass, is a clear, fresh, glassy feldspar, which is much more acid in composition than the main mass. That it is not a simple zonal arrangement, appears from the fact, that the fresh feldspar is found along the breaks as well as around the edges. We must therefore be dealing with a secondary feldspar, which has been formed during or after the metamorphism. This "regenerated" feldspar, as it may be called, is a regular growth through and around the altered variety, and in optical continuation with it, but of a much more acid nature. The new feldspar is clear, fresh and glassy, and contains no inclusions. This regenaration of feldspar is exceedingly interesting, and for a rock of this kind rare. That quartz grains, and at times feldspar, in sandstones and related rocks, are enlarged by secondary processes, is quite well known. That it should occur in other rocks, especially those subjected to the influence of dynamic metamorphism, is therefore not strange. At the same time it is so uncommon, as to deserve special mention. The other rock minerals, consisting now largely of secondary hornblende, and chlorite, (pennine), occupy the spaces between the large feldspar crystals.

The sulphides as usual are most intimately associated with the dark silicates, which they replace in a characteristic way. The feldspars, although strongly altered, have not been extensively replaced by ore, except where they have been crushed and broken, and then the ore is found filling the planes of fracture.

The replacement of hornblende and chlorite by ore, is typically developed, and a number of almost complete pseudomorphs can be seen. (Fig. 5.)

(4). Specimens consisting almost exclusively of ore, do not show anything new. The rock residue consists largely of feldspar, with a small amount of green hornblende, and chlorite. The minerals are all strongly decomposed, and are penetrated by threads of ore along all lines of weakness, and in some cases are almost wholly replaced.

Conclusion.

From the results given above it is possible to draw a number of conclusions, with certainty. Briefly these are as follows:—

(1). The deposits are *not* the result of a direct magmatic segregation from an original magma.

(2). The ores are largely of a secondary nature, deposited from circulating solutions, by a metasomatic replacement of the rock minerals.

(3). The relations of the rock minerals, can only be explained by such a replacement.

(4). Where the effects of metamorphism, in the crushing and alteration of the rock, are most apparent, the largest quantity of ore is developed.

(5). The ore has been introduced into the rock, *after* its complete differentiation and solidification.

(6). The ore first replaces the rock along planes of brecciation and least resistance, and finally extends, till it has replaced considerable masses of the rock.

(7). The ore is most prominently associated with secondary non-metallic minerals, namely hornblende and chlorite.

(8). The different relations of the magnetite and sulphides, to the rock minerals, gives additional proof that the latter are secondary.

(9). Pyrrhotite at first, probably formed the larger proportion of the ore, and chalcopyrite has been introduced still later.

(10). A comparison of this deposit with those of Sudbury and Sohland, show that the three are practically alike.

The ore-bearing rocks are of the same type, with only minor differences of local development. The underlying principles of the ore-formation are essentially similar. Whether the important concentration of the ore, took place during or after, the period of metamorphism, which crushed and sheared the rock, is not clear. It is very probable however, that the metamorphism had a more or less direct effect, in stimulating the circulation of the ore-bearing solutions, as well as rendering the rock permeable to these solutions. The ultimate source of the metals themselves is still problematical. As in the case of Sudbury, the associated basic rocks, can hardly be looked upon as capable of furnishing the necessary amount of ore, by a process of "lateral secretion". The only alternative is therefore, to ascribe a more distant source to the metals, which have received their *first* important concentration by means of *ascending* waters.

Considering our comparative ignorance of the laws governing the circulation of deep underground waters, a discussion of the actual processes, which resulted in the formation of the ore-body as it is to-day, would be purely theoretical.

As the object of this investigation has been to inquire into the *facts*, as presented by the actual occurrence and relations of the ore, and not to go into theoretical details, such a discussion will not be attempted.

The Pyrrhotite Nickel Deposits of Sohland, Germany.

The geology of the interesting nickel deposits near Sohland, Saxony, discovered in 1900, has been described by Prof. Beck, in a recent valuable paper.*

* "Die Nickelerzlagerstatte von Sohland a.d. Spree, und ihre Gesteine." Zeit. der Deutsch. geol. Gesell., 1903.

Other literature on Sohland.

Beck, R. Lehre von den Erzlagerstatten. I Ed. 1900, p. 47; II Ed., 1903, p. 46.

Beck, R. "Ueber eine neue Nichelerzlagerstatte in Sachsen. Zeit. fur prakt. Geol. Feb., 1902, pp. 379-381.

Beyer, O. "Die erste Erzlagerstatte der Oberlausitz." Wissensch. Beil. der Leipziger Zeit. Feb. 13, 1902.

Geology of the Ore Bodies.

The country rock of Sohland is the so-called Lausitzer granite, which is cut by numerous diabase dykes, and often shows the effects of metamorphism. Where the ore was discovered, the granite is fine grained; further east a middle grained variety is predominant. The ores are closely associated with diabase dykes, called "proterobase", striking in a general W.N.W. direction. The main dyke is about 30 to 60 feet wide, and has been traced for more than half a mile. Ore has been found in a number of test pits, and prospecting with a magnetometer, makes it probable that the ore-bearing rock extends at least a mile in length.

The Ore-bearing Rock.

The principal ore-bearing dyke is not uniform in character. It is most largely developed as the so-called "proterobase"; in part it takes the form of a biotite-diabase. Besides these, there are small basic segregations, containing spinel, corundum, and sillimanite.

(a). Proterobase. Without going into petrographic details, the proterobase is a fine to middle grained rock, consisting chiefly of plagioclase, augite, brown hornblende, and brown mica. The chief accessory minerals are, a colorless pyroxene, magnetite, ilmenite, hornblende, talc, chlorite, andr serpentine.
apatite, zircon and rutile, as well as secondary green

(b). Biotite-diabase. The biotite-diabase is much finer grained, and occurs as irregular nodules within the proterobase. Its microscopic structure is typically ophitic. Brown hornblende fails, otherwise it is very similar to the proterobase, with which it is connected by gradual transitions.

(c). The basic segregations are of two kinds. One (not found in place) is characterized by countless octahedra of a green transparent spinel, and a few grains of corundum. The other variety, which is found in the ore body, is made up largely of aggregates of sillimanite, and contains large numbers of spinel and sapphire crystals.

Besides these minor varieties, the proterobase contains inclusions of quartz and granite, the latter strongly altered.

Mineralogical Composition of the Ore.

Besides the magnetite and ilmenite mentioned as original components of the rock, the Sohland ore consists of pyrrhotite, chalcopyrite, and pyrite. The pyrrhotite is largely in excess of the others, and the mining activity is due to the nickel it contains, as the ore is too poor to work for copper alone.

The pyrrhotite is always massive, and two varieties can be distinguished. One is more or less granular and fine grained, the other more coarsely crystalline and platy. Chalcopyrite is always intimately intergrown with the pyrrhotite, especially the finer grained variety. The latter also contains many more inclusions of the proterobase, while the coarser is as a rule comparatively pure, and free from rock and copper.

Analyses of the Sohland pyrrhotite show an average of between 4 and 5 per cent. nickel, for nearly pure material. But in a number of cases I obtained as much as 7 per cent. Copper is generally rather subordinate, averaging between 0,5 and 1 per cent., but at times going as high as 2 to 3 per cent. Cobalt is present in very subordinate quantities, and traces of antimony and silver have been detected.

The Ore-Body.

The ore-bed proper lies in the proterobase at the granite contact. At the bottom of the shaft sunk where the discovery was made, it has a thickness of 6 to 8 feet, which, however, sinks to a foot or less. The granite itself at the contact is slightly impregnated with ore for a few inches. The pay ore ends rather abruptly and beyond is proterobase impregnated with diminishing quantities of sulphides.

The upper part of the vein (Fundschacht) is covered to a depth of about ten feet with clay and the alteration products of the proterobase. Below this, secondary oxidised copper ores appear, (malachite, bornite, chalcocite, etc.). The rock becomes gradually fresher and more strongly impregnated with sulphides, till at a depth of about 30 feet, massive ore is met.

Relations of Ore and Rock.

Examined more closely, the relations of the sulphides to one another, and to the rock minerals, present a number of interesting facts.

In the massive ore, the small amount of chalcopyrite, in part fills narrow clefts in the pyrrhotite, as though a later impregnation along planes of fracture. A bilateral arrangement of the sulphides is also characteristic, and is well illustrated by a number of polished sections in Prof. Beck's collection.

One section shows a narrow band of chalcopyrite, running through the proterobase, which is locally altered and somewhat talcose. On either side of this band, the proterobase is impregnated with chalcopyrite for 3 or 4 inches. Then follows a parallel band of pyrrhotite, which is marked off sharply on the inner side, and fades off gradually to barren proterobase on the outer side. Other sections show similar zonal structures, giving the ore a more or less vein-like appearance. At other times the sulphides are grouped regularly around elliptical or rounded rock masses, apparently along fracture planes. The inner zone is generally chalcopyrite, and is surrounded by pyrrhotite, which passes by a gradual transition to barren rock. The same phenomena have been noted in the Sudbury ore, and they afford one of the clearest proofs of the later introduction of the ore, especially when combined with the microscopic observations.

Microscopic Structure of the Ore.

From the examination of a large number of thin sections of ore, Prof. Beck draws the following conclusions.

(1). The sulphide ores fill a space originally occupied by primary rock constituents.

(2). The sulphides are principally associated with secondary, non-metallic minerals, viz. actinolite, and chlorite.

(3). The sulphides favor places where alteration is well advanced. They occur in all varieties of the rock, but especially in the predominant proterobase.

The general conclusions are supported by concrete examples, and an examination of the slides I have made, fully corroborates the observations of Prof. Beck.

Origin of the Ore.

Prof. Beck's work, as well as my own, then make a number of points clear.

(1). Except for a small proportion of sulphides, which may have been original constituents of the ore-bearing rock, the pyrrhotite, chalcopyrite, and pyrite, have been introduced *after* the complete cooling and differentiation of the rock magma.

(2). Not only so, but a partial alteration of the silicates has taken place, resulting in the formation of actinolite, chlorite, talc, etc., *before* the formation of the ore-bodies.

(3). These relations can only have been brought about by means of solutions.

(4). The peculiar intergrowth of secondary hornblende and ore seems to indicate a previous metamorphic action. The fresher silicates are simply corroded and etched, while a part has been further altered during the action of the solutions and the contemporaneous deposition of ore.

(5). The ore-bearing solutions in all probability, were of a thermal nature, from considerable depths. They circulated along the border of the proterobase, along passages formed by cooling and shearing, and were no doubt closely connected with the latter stages of the proterobase eruption.

The ore-body itself indicates the thermal nature of the solutions, and their origin from the depths of the basic magma. If the process had been a lateral secretion of descending waters, which concentrated the nickel and copper, originally disseminated through the proterobase, it is difficult to understand why the ore is confined to the proterobase along its contact with the granite.

Comparison with Sudbury and Other Deposits.

A short comparison of various sulphide nickel-copper deposits, indicates their essential similarity, both of geological relations, and method of origin.

(1). Regarding their origin, no example of this class of ore-bodies, which I have studied, can be referred to as a direct magmatic segregation from an original rock magma. On the other hand, all the evidence shows that the ores were introduced *after* the complete differentiation and solidification of the magma. Many facts point to the conclusion that the important concentration of the ore, took place *during* a regional metamorphism, probably connected closely with the eruption of the basic rock, and *later* by a stimulated aqueous activity, following the eruption.

(2). Considering the ore bearing rocks themselves, they are found to be essentially similar. They all belong to the gabbro family, and while showing minor points of difference, for practical purposes they can be considered as identical.

(3). The deposits while lying well within the limits of the basic eruptive, generally occur at or near its contact with other rocks, especially granites and mica schists.

The rocks show to a greater or less extent the effects of dynamic metamorphism, accompanied by brecciation and shearing. These are perhaps more apparent in the Subdury field than the others studied, but are never failing.

(4). The mineralogical relations are practically the same in all the deposits. Pyrrhotite containing nickel is predominant. Associated with it are varying amounts of chalcopyrite, pyrite, and magnetite, (usually very subordinate), and the rarer minerals (at times), pentlandite, sperrylite, etc.

(5). The ore frequently occurs as a cement for the brecciated rock fragments and along shear planes. This often gives to the ores a vein-like appearance or zonal structure, as is well seen in both the Sudbury and Sohland deposits.

(6). The rocks associated with the ore are strongly altered, and characterized by the presence of much secondary, green and amphobilitic hornblende, chlorite etc. The effects of metamorphism and the development of secondary hornblende are most marked near the ore-bodies, and diminish away from them. And in general the more complete the alteration of the rock, the more complete has been its replacement by sulphides.

(7). Microscopically the relations of the ore and rock emphasize the fact that the sulphides are a secondary introduction. The relations of the magnetite and ilmenite, which are for the most part primary, are in striking contrast to the sulphides. While the latter are found in positions originally occupied by primary rock constituents, the former are in the form of grains and crystals in the midst of the sulphides, and dark silicates, apparently unaltered and with their original outlines. The sulphides on the other hand, replace both the fresh and altered rock constituents, often forming more or less complete pseudomorphs. The replacement takes place between the fibres of the secondary hornblende; along the cleavages of the fresher and more compact minerals, etching them and breaking them up into granular aggregates; between crystal fragments; and along planes or zones of shearing and parting.

The dark silicates, owing to their chemical composition, and susceptibility to metamorphic changes, are the first attacked. But as the effects of metamorphism become more pronounced, the more acidic minerals (feldspars) are partly or wholly altered, and replaced by ore.

Another interesting fact, noted especially in the Sudbury, Sohland, and Norwegian deposits, is that where the contact is along granitic or gneissoid rocks, the latter have been slightly mineralized. The change is usually accompanied by a migration of secondary hornblende into the acidic rock, and a replacement of its basic constituents by ore. The granite of the Sohland deposit is often sensibly altered and metamorphosed, both as a result of the eruption of the proterobase, and later by the ore-bearing solutions. The schistose and gneissoid contacts of many Norwegian deposits are often penetrated by ore for some distance, along cracks and planes of parting, which can only be explained as a deposition from solution.

Nickel in the Sohland Ore.

At the request of Prof. Beck, I made a number of experiments with Sohland pyrrhotite, in the endeavour to determine in what form the nickel was present. From the general similarity, both in geological relations and mineralogical composition, of the Sohland and Sudbury deposits, it was thought probable that the nickel might be in the form of a definite mineral, such as pentlandite. Both varieties of the pyrrhotite were examined, but no mineral resembling pentlandite was visible to the naked eye. Chalcopyrite in small nests and aggregates is intimately mixed through both the fine and coarse grained ore, and is very difficult to separate from the pyrrhotite.

After crushing, the ore was sized through Nos. 10, 20, 30, 40, and 80 mesh sieves. The various sizes were then magnetically separated by means of a small horse-shoe magnet. Practically none of the ore was *non-magnetic*, except the chalcopyrite, and rock minerals, and these were rejected as well as possible. Part of the pyrrhotite however, was not so susceptible to magnetic attraction as the rest, and this was carefully examined. It was freed from impurities as well as possible, and treated with dilute hydrochloric acid, to remove oxidation products. In appearance the grains were of a very light bronze-yellow color, but showed little trace of the characteristic parting of pentlandite. These were then picked over under a lens, and only the purest part selected. It was found however, very difficult to obtain a satisfactorily pure product, as small particles of chalcopyrite adhered very closely to some of the grains.

Both varieties of the ore were treated in this way, but from the massive fine grained variety, it was impossible to prepare even an approximately pure sample, so the residue from the coarse platy variety was taken. An analysis of the prepared material, showed that it contained 7,5% nickel, and 1,90% copper. As many samples of the purer pyrrhotite in their original state contain as much as 6 or even 7% nickel; and the particular piece examined, slightly over 7%, it is clear that no appreciable concentration has been effected.

In regard therefore to the condition of its nickel, the Sohland ore differs markedly from that of Sudbury. At the present moment it cannot be said that pentlandite *does not* exist in the Sohland ore. But if it does, it must be in a very fine state of division, and intimately and uniformly distributed through the pyrrhotite, so that it cannot be separated by magnetic means.

As another alternative we may fall back on the assumption that the nickel is an essential constituent of the pyrrhotite, isomorphously replacing the iron. A third possibility is that the nickel is present in a definite mineral, which is itself magnetic, and so does not allow a separation from pyrrhotite by means of a magnet.

The results of these investigations, I submit in the hope, that they may throw some additional light on this interesting and important class of ore-bodies, and perhaps help to clear up some of the disputed points in the science of Ore-Deposits.

PROSPECTING FOR IRON ORE IN THE TORBROOK DISTRICT, NOVA SCOTIA.

By W. F. C. Parsons.

Extent.—The territory covered by the titles of The Annapolis Iron Company, Limited, extends practically from the County line between Annapolis and Kings, westerly to the Nicteaux River, a distance of slightly over five miles, and has a width throughout its entire length of about one and a half miles. It may very conveniently be divided into two sections, namely the north section and the south section. The veins run nearly east and west. The north section contains the outcrop of three veins, and the south section the outcrop of two veins.

The north and south outcrops run almost parallel to each other. There is every reason to believe they form the upper edges of a syncline of continuous veins of ore, that is, the outcrop on the north dips under the intervening territory and outcrops again in the south section along the South Mountain.

The northern section has been prospected very extensively. The eastern end has been exploited by the workings of the Leckie Mine, (now operated by the Londonderry Iron & Mining Co.) The main shaft of the mine has been sunk to a depth of 350 feet, levels being started 50 feet apart and extending to the east and west for many hundreds of feet. The lower levels Nos. 3, 4, 5, and 6 are being pushed to the westward in order to open up new territory. The plant at the mine comprises three 40 H.P. boilers and one 80 H.P. boiler, one Lidgerwood hoist and two 12″ x 18″, Allis-Chalmers Bullock Co. straight line air compressors, besides air drills, pumps, etc., as well as boiler, engine and dry houses, blacksmith and carpenter shops, office and superintendent's house.

About one mile west of the Leckie Shaft a new inclined shaft, called the Hoffman, was started upon what is known as the shell vein. The width of this vein is about 5½ feet, and its dip about 85 degrees. Sinking was commenced on this vein in December, 1905. At the latter end of January, 1906, it was sunk to a depth of 163 feet, at which point it was decided to cross-cut to the north of the Leckie Vein, which is about 82 feet distant. This work is now underway. The plant at this shaft consists of one 60 H.P. R.T. boiler, one 12″ x 18″ Allis-Chalmers Bullock, Ltd. straight line air compressor and one 14″ x 7″ x 14″ Knowles sinking pump. The size of shaft is 7′ x 14′. It was only necessary to permanently timber this shaft for the first 25 feet. The balance of shaft is timbered with stulls set about 6 feet apart on either side of the skip road. The walls being very hard and regular, very little water was encountered in sinking. It was handled by bailing except on Sundays, when pump was lowered to keep the water out. Sinking averaged over three feet per day, of three 8 hour shifts. The drills used were Ingersoll Sergeant "D" 24, supplied by Allis-Chalmers Bullock, Ltd. of Montreal. These drills proved suitable for this work.

Another inclined shaft, called the Wheelock, situated one mile west of the Hoffman was commenced in November, 1905. This also is sunk upon the shell vein. The width of the vein is 6 feet and its dip was 77 degrees for 63 feet. Then it flattened to 45 degrees for 15 feet. Then to 43 degrees for 16 feet. At the point where the vein flattened, it increased in thickness to 12 feet. At 94 feet the vein suddenly dipped to an angle of 75 degrees, narrowing again to 6 feet. This was followed to a depth of 116 feet, at which point it took another flatter pitch to the south. It was decided to continue sinking upon the line of the 75 degree pitch. This was sunk to a depth of 170 feet, the last 54 feet in rock. It was deemed advisable to sink in rock owing to the numerous changes in the dip. It would be difficult to operate a skip over these changes of grade. At a depth of 155 feet a cross cut tunnel was started to the north to intersect the Leckie Vein, which is estimated to be about 112 feet distant. This work is now underway. When completed a cross-cut will be started to the south to locate the lost vein. The sinking of this shaft was a comparatively difficult proposition, owing to the quantity of water encountered. Progress of sinking did not average over 2 feet per day. The size of the inclined shaft is 7′ x 14′. The plant is a duplicate of that at the Hoffman Shaft.

It is the intention as soon as the Leckie Vein is intersected at these two shafts to drift upon the veins east and west so as to prove the continuity of the same.

Two boreholes were put down by the Nova Scotia Steel Co. in this district. One, a diamond drill hole, is situated about 550 feet west of the Hoffman Shaft. From Government records, this hole proved the shell vein at this point to be 5′ 2″ wide and the Leckie about 6 feet. There is also a third vein about 2 feet.

The second hole is a 5″ Calyx, sunk to a depth of 387 feet on the farm of Josephine Wheelock, about 1,500 feet east of the Wheelock Shaft. The Government records show that at a depth of 330 feet from the surface, ore was intersected, and at a depth of 387 feet this hole was still in ore. It is estimated that the shell vein at this point is at least 9 feet wide and of good quality, iron tenor 49.5%. Messrs. Brookfield & Corbett, who owned the property at this time, continued this hole for another 7 feet. This core showed indications of approaching the foot wall. However, the analysis showed the ore to run considerably over 40% metallic iron.

A borehole was sunk some years ago by Messrs. Brookfield & Corbett on the farm of Fletcher Wheelock. This hole is about 350 feet east of the Wheelock Shaft and 40 feet south of the shell vein. The Nova Scotia Government records show that it cut the three veins, shell vein at 112 feet, width of vein 15 feet; Leckie vein at 330 feet, width 9 feet; 3rd vein 435 feet, width of ore 14 feet.

It should be stated that the shell vein from the Hoffman to the Wheelock Shaft is a magnetic ore due no doubt to the proximity of diorite.

The following analyses shows the quality of the ore in this district, that is, from the Leckie Mine to the Wheelock Shaft where the prospecting work has been confined. From the numerous samples taken from the Leckie Mine, the analysis may be stated as Metallic iron 52.00%, Phosphorus 1.15%, Sulphur 0.02%, Manganese 0.10%, Insol. 13.5%, Magnesia 0.30%, Lime 2.5%.

Hoffman Shaft on shell vein iron 47.47, phos. 1.32, insol. 17.23.

Wheelock Shaft on shell vein iron 49.00%, insol. 15.28, phos. 1.02, lime 3.35, magnesia 0.57.

Page & Stearns farm, shell vein, iron 50.00%, insoluble 16.00.

Leckie vein, iron 50.55%, insoluble 13.65.

George Holland, shell vein.

Leckie Vein, iron 51.95, insol. 11.57, phos. 1.517, lime 3,21.

Southern section. This section, mentioned before as being the southern outcrop of syncline, extends three miles and contains an area of two and three quarter square miles. It has not been as thoroughly prospected as the northern one. The ore is a black magnetite of varying qualities, the western portion of the area being the better. Analyses of samples taken from surface pits, runs as high as 50% metallic iron and as low as 36%.

THE ROBINSON GOLD DREDGE.

We illustrate in this issue a new gold dredge designed by Mr. A. W. Robinson, M. Am. Soc. C.E., and which is now being built by the Atlantic Equipment Company, of 111 Broadway, New York. In view of the growing importance of gold dredging, this dredge merits more than a passing description.

The introduction of gold dredges into the United States on a commercial scale dates from 1895. In that year a small electrically-operated dredge was installed on Grasshopper Creek, at Bannack, Montana. This dredge was built from Mr. Robinson's designs and was the precursor of several others in the same locality, all of which did well and made money for their owners. These early dredges represented a combination of a dredging apparatus with an hydraulic sluice-box, and in both these elements the original separate forms were adhered to. The dredge was of a type and detail which had been successfully used by Mr. Robinson for river and channel dredging, and the sluice-box was similar to that long used successfully by miners in hydraulic mining. A type was thus established which, improved in detail, has been a favorite.

The elevator type was soon recognized as the most successful one for gold dredging, and the history of many experiments with others is one of failure. Subsequently, the New Zealand type of dredge was introduced. This differed from the American type in having mooring lines instead of spuds, and a fine screen and tables covered with riffles or fibre for saving the gold, in place of the sluice-box. In New Zealand, however, the gold is fine, and the ground comparatively soft, or alluvial, and the early dredges were found to be too light for the harder service of this country, and were too cheaply built. Then followed a period in which the two types of dredge, American and New Zealand, were strengthened and improved by their respective makers, until some recent examples show such great size and weight of parts that the cost is greatly increased. That the durability and cost of repairs is still far from satisfactory in the average dredge, is shown by the report of the State Mineralogist of California for 1905, from which it appears that the cost of repairs frequently amounts to fifty per cent. of the whole operating cost. In a typical example, where three dredges were working together, the average operating cost for the three during the year 1903 was (in cents per cubic yard) as follows:—

Buckets of the Robinson Gold Mining Dredge.

Dredge crew, power and operating supplies	2.52
Repairs, labor	.48
" supplies	2.58
Superintendence	.16
General expense	.15
Taxes and insurance	.24

In the present design the aim has been to produce the very simplest construction of working parts that will accomplish the desired result, and to maintain a large margin of strength as well as durability. All the best features of both New Zealand and American practice have been retained, and complications and weight reduced as far as practicable, by correct design and the use of high grade steels, with as little cast iron as possible. The result is a dredge that is light, strong, easily handled, economical to transport and erect, and that can be depended on to do its work continuously and with light repairs. This dredge made a run of 76 per cent. actual working time during her trial period of 30 days. The total delays thus amounted to 24 per cent. of the time, and included all the time lost in adjusting the new machinery, and in correcting small defects, which when once done would not occur again, so that it is expected that in regular work much better time will be made. Old established dredges on regular runs, seldom average more than 75 per cent. running-time on account of incidental and unavoidable delays.

The dredge herein illustrated and described is the property of the Gold Bond Dredging Company, J. B. Austin, president, Ransom's Bridge, N.C. It is at work in an alluvial flat forming the bottom of a low valley and through which runs a small brook which would readily pass through an 8 inch pipe, and which keeps the pond supplied. The ground is covered with heavy pine timber which when cut yields fuel for the dredge, and the stumps are readily dug out by the dredge itself. Gold is found in good paying quantities, and is of varying degrees of fineness.

The hull is of wood 94′ x 32′ x 7′. It is very strongly built, and the well sides are carried aft the whole length of the boat to form bulkheads. There are also steel hog-rods forming two fore and aft trusses. The ladder-frame is of steel and long enough to dredge in thirty feet of water. The buckets are of Robinson's Patent Improved Close-connected type of 3 cu. ft. capacity each. The back of the bucket is of cast steel. The pins are 3 inches diameter of steel, and the bushings are of manganese steel. These bushings are specially made to slip in or out of recesses shaped to a half circle, so as to be readily renewed. The lower tumbler shaft is of hammered steel and runs in enclosed bearings in the end of the ladder-frame; these bearings also have renewable bushings. The upper tumbler is of cast steel five-sided, and is fitted with Robinson's patent driving faces, by means of which the driving power of the tumbler is applied directly under the centre of the bucket-pins, instead of the usual over-hang due to the links working on the polygonal faces. The strain and wear on both buckets and tumblers is thus reduced. The buckets run at a speed of 24 per minute. This is equal to buckets of 6 cu. ft. capacity of the open-connected type, running at 12 per minute. The buckets discharge through a steel hopper into the revolving screen, which is 4 feet 6 in. by 16 feet. This screen is made with interchangeable, perforated plates on a steel frame, so that the plates may be removed without taking down the screen.

Robinson Gold Mining Dredge Working in an Alluvial Flat.

The head-frame and driving gear for the buckets and screen are strong and simple, there being but two working shafts and four bearings in the entire machinery, including tumbler and screen drives. These two shafts are the upper tumbler shaft, and secondary, or pinion, shaft. The main gearing is of steel, and a steel-rimmed pulley of large diameter on the end of the pinion-shaft is directly belted to the main engines on deck. The revolving screen is driven from the secondary shaft, which passes directly above it. On the screen is a cast steel spur gear of 2″ pitch and 6″ face, which also has a flange or roller-patch attached to it. The screen is mounted on adjustable steel rollers running in dirt-protected bearings. An adjustable friction clutch is provided at the main pinion, which will slip in case of sudden strain, but the belt transmission also furnishes a safeguard.

The main engines are of 50 h.p. of vertical marine type. In this case they are double cylinder high pressure, for the sake of simplicity, as wood fuel costs only the labor of cutting it—about $1.00 per cord. For situations where greater economy of steam is important these engines can, of course, be made compound condensing. The main engines are handled entirely by the operator on the upper deck. Here he has a full view of his work, and can see the buckets for their whole length and the tailings conveyor as well.

The winch is on the main deck directly under the operator, so that the levers for its various motions can be conveniently placed. It has six drums each with independent friction clutch and brake, as follows:—One headline, one ladder hoist, two forward side lines and two after side lines. By means of these steel wire rope lines, the position and feed of the dredge is under perfect control.

The water supply for the screen and tables is furnished by an independent centrifugal pump with 10″ discharge, and having direct connection with the engine.

Steam is furnished by one boiler of the Worthington water-tube type of 125 h.p. It is, especially, adapted for burning inferior wood, as the firebox is large and roomy, and covers the entire bottom area of the boiler. The boiler has a steam and water drum of sufficiently large dimensions to prevent sudden fluctuations of pressure and water-level. The consumption of green pine wood will run from 2 to 2½ cords per shift of 12 hours, steady working. This is sufficient to show the remarkable economy of this dredge. Assuming the actual output of the dredge to be 1,000 cu. yds. per shift of 12 hours (which is half its theoretical rate, and is a low average in practice), and the cost of fuel to be 2½ cords of wood at $1.00 per cord, we have a fuel cost of one-quarter of a cent per cubic yard of material handled.

The gold-saving tables are arranged on both sides of the after deck, under a distributing-box of special design, by means of which the wash from the entire length of screen is mixed and distributed uniformly to the tables.

To save a high percentage of gold requires, first, thorough washing of the gravel; second, proper concentration; third, thorough mixing and even distribution of the concentrates over the tables; and fourth, a riffled surface on the tables, that in area, slope, and type of riffle are well adapted to the particular material to be dealt with. A correct understanding of the principles of gold-washing is necessary, as well as a correct diagnosis of the local conditions to be met. What will suit one locality may be a failure in another. The system of tables adopted in this dredge is a flexible one that can be adapted to any material and hold any kind of riffle. There are 28 tables, each 1½ ft. x 8 ft., or a total surface of 336 square ft. In addition, there are 94 sq. ft. of riffles in the distribution and tailings sluices, or a total of 430 square feet of riffle surface.

To carry off the coarse tailings a stacker or tailings conveyor 70 ft. long is employed. This is of the rubber belt type, driven by an independent engine. The belt is 30 inches wide and the end of the conveyor is 25 feet above the water level. The load of all the parts is well balanced on the hull so that it sits level at a uniform draft of 3 feet.

The increasing use of the dredge for working low-lying and low alluvial ground has opened up a wide field for this class of mining. Formerly ground that would not pay over 25 cents a cubic yard was not considered profitable, and this is probably still true in the far north and in localities where freight, fuel and labor are expensive, but under ordinary conditions ground which was formerly thought worthless can now be worked at a profit.

"THE EARLY USE OF IRON."*

By Bennett H. Brough.†

R.S.M., F.I.C., F.G.S., F.C.S., we have received an advance proof of his address before the West of Scotland Iron and Steel Institute, on "The Early Use of Iron." With the present remarkable development that is occurring in the iron industry of Canada, we reproduce the same, as being of, probably great interest to those of our readers who are keen followers of the fortunes of that industry.

In accepting the invitation with which I have been honoured by the Council to give a lecture to the West of Scotland Iron and Steel Institute, I feel that an apology is needed for having chosen a literary and antiquarian subject, that is inconsistent with the essentially practical nature of these meetings, and possibly with the very objects of the Society. At the same time, I think that many of the members will be willing to devote an hour to inquiring into the obsolete practices of their earliest predecessors, and to casting a glance backwards to the beginning of the great industry with which they are all so intimately connected. The subject of the early use of iron has already been ably dealt with in papers read before the Philosophical Society of Glasgow, by St. John Vincent Day in 1871, and by Professor A. Humboldt Sexton in 1900. Since the publication of these papers, however, much fresh light has been thrown on the subject by numerous archæological and literary researches. I propose, therefore, to give a brief summary of the results of these researches, and to set forth, as fully as possible in the time available, the existing knowledge of the metallurgy of iron and steel prior to the introduction of the blast furnace.

The date of the discovery of iron has long been a matter of controversy; and it is generally believed that the iron first used by man was of meteoric origin. In support of this view Mr. Otto Vogel has given quotations from the earliest Finnish poem; and Sir Henry Bessemer in 1895 adduced evidence to show that the tools used in the construction of the pyramids must have been made of a meteoric nickel-iron alloy. The theory is, however, open to considerable doubt, in view of the difficulty of working meteoric iron. Indeed, many authorities have denied that meteoric iron is malleable. The hypothesis is, nevertheless, an attractive one. Blocks of meteoric iron, though not very numerous, have been found in all parts of the world. The British Museum collection, which includes specimens of nearly all the meteoric irons known, numbers 229, one of which fell in Great Britain, at Rowton, Shropshire, on April 20, 1876. The most remarkable of the larger masses was found in West Greenland, whence it was transported in 1894 by Captain R. E. Peary to the American Museum of Natural History in New York. It is of very irregular shape, 11 feet long, 7½ feet wide, and 6 feet thick, and weighs nearly 50 tons. The knowledge that iron and stones from time to time fell from heaven is very old. The meteorite still revered by the Moslems as one of their holiest relics, of which the history goes back far beyond the seventh century, is the oldest preserved. A fall mentioned in old Chinese manuscripts happened about 644 B.C. The oldest undoubted meteorite still preserved was seen to fall on November 16, 1492, at Ensisheim, in Alsace, where it was long suspended by

*Advance copy.

†Through the courtesy of Mr. Bennett H. Brough, Assoc.

a chain in the parish church, and is now kept in the town hall. The ancient Greeks and Romans supposed the stars to be the home of the gods. Falling stones signified the descent of a god, or the sending of its image to earth. The envoys were received with divine honours. A meteorite which recently fell in India was decked with flowers, daily anointed with clarified butter, and subjected to ceremonial worship. From 400 B.C. to 300 A.D. coins were struck in honour of such divinities. As a rule the images were naturalistic in olden times, and became human-like afterwards. Among the meteorites in whose honour coins were struck were the Omphalos of Delphi, a black stone given to Uranos instead of the new-born Zeus, the stone of Astarte which fell as a star from heaven and was worshipped at Sidon, represented on a coin of the Emperor Elagabalus lying on a car, and the conical stone of Aphrodite Urania. The rarity of meteoric falls is opposed to the theory that meteoric iron was the material used by prehistoric man; and although some meteoric iron is malleable, and there are undoubted cases in which it has been successfully forged, the difficulty of obtaining tools suitable for cutting a meteorite makes it probable that this material was used only in exceptional cases, and that the first discovery of iron was due to the accidental melting of a rich iron oxide with charcoal.

The period of the first use of iron in Ancient Egypt has been warmly discussed. Some contend for its use in mythological times, while others would bring it as late as 600 B.C., and, disregarding all evidence of the discovery of iron remains, insist that stone, copper, and bronze tools were used exclusively up to that date, even in the building of the pyramids. These wonders of the world, the graves of Egyptian kings, were built 3000 years before Christ. Herodotus tells of the building of the Great Pyramid, stating that 100,000 men were employed for twenty years; and he expresses wonder at the amount that must have been spent on their board and clothing, and "on the iron with which they worked." The accuracy of the statements of Herodotus is borne out by the present condition of the Great Pyramid, which is built of granite blocks from the Upper Nile, lined with slabs of nummulitic limestone from Arabia. The magnificent temple at Thebes and the obelisks of a later period afford striking evidence of the technical skill, mathematical knowledge, and excellent tools possessed by the ancient Egyptians. The evidence of ancient Egyptian metallurgy and mining are not of less importance. Gold was, of course, the metal most prized. There is preserved in the museum at Turin a map, drawn 1400 years before the Christian era, showing the situation of some ancient gold mines—undoubtedly the oldest topographical plan in existence. Diodorus describes how these mines were worked by slaves, and gives a harrowing picture of the hardships they suffered in these ancient Egyptian penal settlements. That iron was known to the Egyptians, even in the earliest times, is evident from their conspicuous metallurgical knowledge, and from the facts that the working of granite and porphyry is scarcely conceivable without steel tools, that the oldest tombs have inscription referring to iron, and that sources of supply of manganiferous iron ore were found by Professor Bauerman in Upper Egypt. All possible doubt has been removed by remarkable archaeological discoveries. An iron sickle, found by Belzoni under the feet of one of the sphinxes at Karnak, is deposited in the British Museum, and proves that the smith's art was practised at about 600 B.C. In 1837 a fragment of a wrought-iron tool was found in blasting operations in the Great Pyramid. This piece of iron nearly 5000 years old, is also preserved in the British Museum. Analysis showed it to contain a small proportion of nickel: but as it also contained combined carbon, it was not of meteoric origin. In the British Museum there is also exhibited a lump of what is now iron rust, which was found wrapped up in a fabric with a mirror and tools of copper dating back to 3300 to 3100 B.C. Much stress is laid by supporters of the theory of the primitive use of meteoric iron on the interpretation of the Egyptian word for iron, "benipe," as "metal from the sky." In view of the fact that in Egyptian mural paintings blue is the conventional culour for iron, one cannot help suggesting that the word might be translated as "metal of sky-blue." Much of the metal used in Egypt was imported as finished material from Ethiopia, and later from Phœnician merchants. Indeed, it is probable that Ethiopia was the earliest centre of iron manufacture. The illustrations preserved of Egyptian iron manufacture show that the process was precisely the same as that still obtaining among Ethiopian races. On a stone, preserved at Florence, a negro slave is depicted working bellows from which the blast is conveyed by a bamboo pipe to a shallow pit in which the iron is smelted. In a second illustration is shown the forging of the iron by hammering it with a rounded stone on a stone anvil with wooden base. It is clearly proved by pictures on Egyptian tombs that bellows were in use in the fifteenth century B.C. This shows a distinct advance over the primitive method of smelting on a windy hillside; and it is curious to note that even at the present day furnaces with a natural air draught are used for lead-smelting in Bolivia. An idea of the relative value of iron in the fifteenth century B.C. is given by the story told by Herodotus (ii. chap., 135) of the beautiful Rhodopis, who, having amassed great wealth in Egypt, wished to leave a memorial of herself in Greece. She therefore determined to have something made, the like of which was not to be found in any temple, and to offer it at the shrine at Delphi. So she set apart a tenth of her possessions, and purchased with the money a quantity of iron spits, such as are fit for roasting an ox whole, which she presented to the oracle. Rhodopis lived in Egypt in the reign of Amasis (570 to 526 B.C.).

Turning to the eastern neighbours of the Egyptians, the Semitic peoples inhabiting the country between the Mediterranean and Persia, we find that iron was known to the Chaldeans from the earliest times. The action of rust has, however, prevented discoveries of much in the way of iron in the ruins of Babylon. Only iron rings and bracelets have been found. A cuneiform inscription in the British Museum is interpreted to mean "With an iron sword I slew another lion." In 1867 the discovery was made in the ruins of the palace of Khorsabad of a store of merchant iron perforated with holes to facilitate transport. It is evident that the kings of Assyria stored up in their treasure-houses masses of iron for building and war. The Assyrians were acquainted with steel, but, like all other ancient peoples, had no knowledge of cast iron.

In Syria the fame of the swords sold in the market at Damascus dates back to the earliest times. In the time of Abraham, Damascus was an important commercial centre. At a later date the Roman Emperor Diocletian had a sword factory there for his army; and even in the time of the Crusades the swords made of a combination of steel and wrought iron polished and lightly etched were prized throughout Europe. Iron was worked with skill; and long before Moses came to Canaan there was a high degree of civilisation in this promised land, that was inherited by the Children of

Israel and the Phœnicians. The latter traded throughout the world in the rich products of Palestine, and possessed greater skill in metallurgy than the Israelites, as is well shown in the Biblical account of the metal work of King Solomon's temple. Numerous Scriptural references show, however, that the Israelites had an intimate knowledge of the working of iron and steel. Iron was known in the days of Job (xxviii. 2). Moses mentions "Tubal-Cain, an instructor of every artificer in brass and iron" (Gen. iv. 22), and compares Egypt to "the iron furnace" (Deut. iv. 20). Og, king of Bashan, who lived about 1450 B.C., had a bedstead of iron (Deut. iii. 11). Joshua (ch. x., verse 20), it will be remembered, besieged Lachish, a city of the Amorites, which then became an important stronghold of the Israelites. It was finally deserted about 400 B.C. The mound has recently been explored by Petrie, who found in the remains of the Amorite city (probably, 1500 B.C.) large weapons of pure copper; above this dating 1250 to 800 B.C., appear bronze tools, which gradually become scarcer, until at the top of the mound there is little else than iron.

To our forefathers the Aryans in India iron was known at a very early date, and used for weapons and tools. Iron ore was abundant; and the lack of copper makes it probable that the iron age in India was not preceded by a bronze age. Indian iron and steel, even in very ancient times, were celebrated throughout the world; and the knowledge of metallurgy possessed must have been considerable. Evidence of this is afforded by the iron pillar at Delhi, which is 50 feet high and 16 inches in diameter, and appears to have been made of 50-lb. blooms welded together. It dates back to at least 912 years B.C. The primitive processes of iron and steel manufacture in India are described in detail by Dr. Percy; and in 1905 Dr. A. K. Coomaraswamy described the processes still surviving in Ceylon. The furnace is sheltered beneath the thatched roof of a shed open on all sides. The essential parts of the furnace are the well or furnace proper, a wall of sticks and mud to protect the bellows-blower from the heat of the fire, and the bellows behind the wall. The bellows consist of two hollowed logs of wood embedded in the ground, with a piece of deer-skin stretched over each, with a small hole near the centre to which a cord is attached. This is fastened above to a springy stick, the lower end of which is fixed in the ground. A small pipe conveys the blast into the furnace. The bellows-blower places a foot on each skin, and pressing his feet down in turn drives a continuous blast into the furnace; his foot acting as a valve, and the skin being pulled up by the tension of the cord. There is a bar for the blower to grip, and a strap to serve as a seat. The ore, limonite, is roasted previous to charging. The furnace is filled with layers of roasted ore and charcoal. When the bloom is ready it is taken out in long tongs made of green-wood sticks. Steel is sometimes made by a somewhat more delicate process. The wall and bellows are similar to those used for iron smelting, but the hearth is merely a semicircular depression filled with charcoal, into which the blast is conducted. Around this actual hearth is a low clay wall. The steel is made in clay tubes, each 8 inches long and 2 inches in diameter; the clay being 14 inches thick. Into it is placed a piece of iron and some chips of wood; the proportion being 12½ ozs. of iron to 5 ozs. of wood. The tube is then closed with a lid of clay, with small holes pierced for the escape of gas. The tubes are imbedded in the charcoal, and a fire started. Very soon the gases from the wood burn off; the blowing being stopped in the meantime. Then the blast is kept up continuously, while the tubes are turned about. When the steel is likely to be ready, a hole is opened in the front part of the hearth so that the blast goes right through the furnace, and the tubes are lifted up one by one in long iron tongs and shaken to ascertain if the steel is liquid. The tubes are then allowed to cool, and subsequently broken open and the bar of steel removed.

The Indian methods of iron and steel manufacture were brought to European knowledge in the Middle Ages by gipsies, who appear to have come originally from India. In Hungary at the present day they carry on iron smelting and forging.

Another classic land for metallurgy is Armenia, the land of the Chalybes, whence the kings of Assyria drew tribute of iron. The Chalybes were regarded by the Greeks as the inventors of steel, and the name of the people was applied to steel.

Recent researches on early Chinese history have brought to light references to the use of iron and steel dating back to 2357 B.C. Marco Polo, the Venetian, in the thirteenth century refers to the use of coal in China; but he gives no particulars of Chinese iron manufacture.

Japan appears to have been colonised from China about 1240 B.C. Japanese copper has been famed from the earliest times, and iron ore has long been mined. The mining operations until the introduction of Western methods were of a primitive character; but considerable depths appear to have been reached. Swedenborg, writing in 1734 ("De Ferro," p. 194), states that the Japanese made their steel by forging iron into bars and burying these bars for eight or ten years in marshy ground; the unrusted portion then being steel. This process is described by several classic writers as being used elsewhere. It would be interesting to ascertain if there is any basis of truth in this description of the method of dealing with the mixture of wrought iron and steel produced by the imperfect smelting process used. The high quality of Japanese swords is far-famed; and the method of manufacture which enables them to be made still survives. The ore used was chiefly magnetic sand, which was obtained as far back as the year 1264. The ore was concentrated to about 60 per cent. of iron. The blast, which was worked by hand, was intermittent. The furnaces were rectangular, 10 feet long and from 4 to 6 feet high. The product is in part cast iron and in part a lump of malleable iron and steel. The antiquity of the Japanese iron industry has been proved by Professor Gowland, who has made a thorough study of Japanese metallurgy. In his investigations of Japanese dolmens, or stone burial chambers, dating from the second century B.C. to 700 A.D., he found iron swords, arrow-heads, spear-heads, and horse-furniture. In most countries the remains found in dolmens are of stone or bronze; but in Japan all belong to the iron age.

In Africa the metallurgical operations of the negro peoples who are regarded as the original inhabitants, present special interest. There was in Africa no bronze age, and the development of iron metallurgy was spontaneous. In Abyssinia the smith is looked upon with mingled dread and superstition. He is supposed to be able to communicate his magic power to others, and to turn himself into a hyena at will. The primitive African methods of iron and steel making in furnaces worked by natural draught have frequently been described. The most recent and most detailed account was that given by Mr. C. V. Bellamy in a paper read at the New York meeting of the Iron and Steel Institute in 1904, in which he described the process carried out in West Africa in the hinterland of the British colony of Lagos. The ore used is a siliceous hematite occurring in shale. It is roasted, and then pulverised in a wooden mortar. The pounded ore is then washed by women. A hole is dug in the ground about 2 feet deep and filled with water. In this a woman stands, and washes the ore in a tray about 18 inches in diameter. It is then subjected to a further and more careful washing by a second woman, seated on the ground near by. The ore is then conveyed to the furnace in a smelting shed, of which there are eleven in the village. Each shed is about 25 feet long and 16 feet wide, with a doorway at each end. The walls are built of clay, and are from 4 to 6 feet high. They are not carried up to the roof, but a space is left all round for light and ventilation. From the ground to the ridge of the roof the height is 25 feet. The furnace is in the centre of the shed. It is built of clay, and occupies a circular space 7 feet in diameter. Its height is 3 feet 9 inches. Opposite one of the doorways, a depression in the floor gives access to the furnace. The dome of the furnace is bound round by a rope of twisted vines. In the centre of the bottom of the furnace is an aperture 3 inches in diameter which communicates with a short tunnel below the floor of the shed, to which access is obtained by a pit inside the shed. The shed also contains a small kiln for firing the earthenware tuyeres, and an ore-bin; both being made of clay. The process of smelting occupies 36 hours; draught being supplied by nine pairs of earthenware pipes. These are only rudely shaped by hand around a stick, and but partly baked. The average diameter of each pipe is 1.4 inches. Selected slag from each successive smelting is used as flux. It is run off by opening the orifice in the bottom of the furnace. For removing the bloom, the clay seals over the six apertures are broken up, the earthenware pipes removed and thrown aside, and the doorway of the furnace opened. The contents of live charcoal are raked out, and the 70-lb. bloom removed in a red-hot state by a loop of green creeper. Subsequently it is broken up, with the aid of a stone, into convenient sizes, and sold to smiths. The metal produced in this way is a natural forged steel, which by reheating by the native smith is brought down to a tool steel with 1 per cent. of carbon. It is difficult to realize that in a part of the world which is within twenty days of the great European manufacturing centres, the smelting methods practised by the earliest ironworkers can still be seen in operation.

From western Asia and Egypt civilisation came to Greece. Cyprus and Crete were the oldest Phœnician settlements; and these islands were the starting-points of Greek metallurgy. Hephæstus (Vulcan) was, according to tradition, the first to work in iron; and he is often represented forging the bolts of Zeus. References to "iron wrought with much toil" are frequent in the poems of Homer (B.C. 880). Hardening steel by quenching is adopted as a simile in the description of the blinding of Polyphemus (Od. ix. 391). Iron is referred to as a treasure, and a bloom of iron is the valuable prize offered by Achilles at games (Il. xxiii. 826). Evidently a considerable degree of skill in working iron had been attained. But the heroes used copper or bronze; metallurgy and mining being still in Phœnician hands. The silver mines at Laurium, in Attica, were even then being worked with slave labour by the Phœnicians. An iron knife and an iron dagger were found by Schliemann in his excavations on the site of Troy. The oldest mines worked by the Greeks were the iron mines of Eubœa (Chalcis). From the earliest times the Spartans wore iron rings, and used iron bars as currency—a practice that was not abandoned until B.C. 320. Little is known of the methods of iron smelting used by the Greeks, as the metallurgical treatises written by Aristotle (B.C. 384-322), and his pupil Theophrastus (B.C. 372-287), have not been preserved. Somewhat obscure passages in the latter author's book on stones indicate that the Greeks were acquainted with the coking of coal, with the use of coal, in iron smelting, and with the tinning of iron. Aristarchus, however, in the second century B.C., says definitely that iron cannot be melted or cast. Although written records are sparse, the numerous sculptures and painted vases that have been preserved throw some light on the metallurgical methods of the ancient Greeks.

Passing on to Italy and the Romans, we find that mining and metallurgy were early practised by the Etruscans. Copper and iron were mined in their own land, notably in Elba and in the Tuscan hills. Diodorus Siculus (a contemporary of Julius Cæsar) and Aristotle refer to the great antiquity of the Elba iron mines, which were originally started to work a copper vein. Among the Romans iron appears to have been used earlier than bronze. One of the oldest customs of the Romans was to wear iron rings on the right hand. Even the statues of the kings Numa Pompilius and Servius Tullius bear these rings. Pliny (A.D. 23-79) refers at length to the custom (xxxiii. 4, 5, 6). In the early days of Rome there was little scope for metallurgy; but with the Punic wars, culminating in the sack of Carthage, the foundation of the world's empire of Rome began. All the mines in Europe gradually fell into the hands of the Roman State, and were worked by slaves. The details of metallurgical practice supplied us by Latin authors are as sparse as those of the Greeks. Most information is supplied by Pliny's Natural History. Iron he describes as the best and at the same time the worst help to man, and, as the metal of foolhardiness, better suited than gold for war and murder. He gives interesting details of the manufacture of iron. He notes that the differences in iron are remarkable, and that on smelting the ore the iron becomes liquid like water ("mirumque cum excoquatur vena aquae modo liguari ferrum"). He describes the Bilbao iron-ore deposits, and refers to the medicinal value of iron. Next to the Elba iron, the Styrian (Noricum) iron is mentioned by him as the most celebrated at this epoch.

The wonderful mechanical skill of the Greeks and Romans is well shown in the works of Vitruvius (B.C. 46) and of Hero of Alexandria (B.C. 285-222). The water level of Vitruvius is a surveying instrument of great accuracy; and the automatic coin-in-the-slot machine and the toy steam turbine of Hero of Alexandria suggest how rapid might have been technical progress had not thirst for conquest on the one hand, and envy and revenge on the other, given rise to wars and massacres that caused the inventions and progress made to be swept away and ignored for five hundred years.

It is difficult to realise the mass of artistic treasures that were destroyed when the Asiatic barbarian Huns burst across the Volga in the year 374 A.D. Manufactories were also destroyed. The iron trade suffered; but iron weapons were needed, and the primitive furnaces in the forests remained untouched. There are no written records of these furnaces of prehistoric time; and all we have to guide us are the archæological discoveries which year by year add to our knowledge of the metallurgical practice of the ancient inhabitants of Europe.

Numerous iron objects of prehistoric date have been found in northern Europe, where iron was undoubtedly the first metal to be used. Iron weapons, too, have been found in the remains of pile dwellings in Switzerland. In that country the Bernese Jura abounds in remains of prehistoric iron smelting, which have been carefully investigated by Quiquerez, a scientifically trained mining official. The furnaces were in dense forests, in order to obtain an easy supply of wood. The workmen dwelt in caves, and charcoal was burned in piles. The furnaces were all similar, differing merely in size. On the natural ground, with no foundation, the hearth of fire-brick was laid. Lumps of the same material formed the walls, which were supported externally by undressed stones filled in with the earth. Two inches above the hearth a channel was left open, which had the entire width of the hearth, was arched over, and widened out at the exterior. It was made of fire-clay; the aperture consisting of several large stones which were covered with a stone slab. The shaft of the furnace was cylindrical, and inclined towards the top, so that charcoal and ore would pass down on one side, leaving the other free for the air-current. The shaft was 8 feet high, and the top was surrounded by a circle of stones. The furnaces were charged from above. The air entered at the base; no bellows being used. The opening at the base thus served as a tuyere, slag hole, and discharging hole for the blooms, which were from 30 to 50 lbs. in weight. At several of these prehistoric furnaces flint implements were found; showing that the Swiss iron industry dates back to the stone age, before bronze was introduced by foreign merchants.

In 1905 Mr. G. Arth and Mr. P. Lejeune made an investigation of a prehistoric mass of metal found near Nancy at a depth of 15 feet below the surface. The mass is 660 lbs. in weight, and was accompanied by fragments of charcoal and slag. It appears to have been the base of an ancient hearth in which the metal had been subjected to repeated and prolonged heating. The metal contains, in addition to iron, 1.21 per cent. of combined carbon, 0.04 per cent. of graphite, 1.67 per cent. of silicon, 0.026 per cent. of sulphur, 0.013 per cent. of phosphorus, and 0.18 per cent. of manganese. It is, therefore, a steel containing a higher percentage of silicon than that now usual. The slag contains 63.9 per cent. of silica. The microscopic examination showed that it belongs to Guillet's first group of silicon steels—pearlite steels consisting of a solid solution of iron silicide in iron. The low percentage of phosphorus indicates that the ore must have been obtained from the abandoned thick bed of ore, and not from the phosphoric "minette" now mined in the district.

The prehistoric cemetery at the salt-mining town of Hallstadt, in Upper Austria, has proved the most remarkable source of supply of bronze and iron implements. The number of graves opened was 993, and the number of objects found was 6084. Nowhere else has such a mixture of bronze and iron objects been found. Salt has been mined at Hallstadt since the earliest times; and modern mining operations have encountered the old workings of the prehistoric miners, and the objects found render it evident that salt mining was here carried on 900 B.C. The prehistoric mines reached depths of as much as 200 yards. Wedges of serpentine, tools of copper and bronze, numerous wooden articles, and remains of skin clothing, have been found, in good preservation. Specially noteworthy are two sacks for the transport of salt, preserved in the Vienna Museum. They are 30 inches long, and made of raw ox-hide. For carrying the sacks there is a leather strap that passed over one shoulder, and a wooden handle 15 inches long fastened by two straps to the upper part of the sack. With this handle the sack could be securely held when full; and on releasing the handle, the contents of the sack could be tipped backwards. A loop was provided for hanging up the sack. The finds at the Hallstadt cemetery bave been classed by Montelius according to the swords discovered. The first period (850 to 600 B.C.) is characterised by bronze swords, and the second (600 to 400 B.C.) by iron swords. There are also transition bronze swords with iron blades.

The civilization of La Tène presents several important contrasts to that of the salt-mining community of the Austrian Tyrol. The site which has furnished a name for the second half of the early iron age (400 to 1 B.C.) has yielded an enormous number of antiquities. It lies in a small bay at the northern end of the lake of Neuchâtel; and the ancient settlement was built on piles. Among the relics from this station, exhibited in the British Museum, may be mentioned an iron brooch, an elaborated form of the modern safety-pin. The ring or collar which kept the end in position is characteristic of the locality. The La Tène swords also have characteristic scabbards; and some remarkable short swords, of this period, with bronze handles of the anthropoid type, are shown in the British Museum. They are named from the human head in the angle of the pommel. The handles are not of solid bronze, but have an iron core. In Spain iron swords of yataghan type are a peculiarity of the La Tène period. In East Yorkshire, Mr. J. R. Mortimer described, in 1905, the discovery of a sword of this period of a kind not previously found in Britain,and believes that it may date from 100 B.C.

Dr. Hjalmar Braune in 1905 published an analysis of a prehistoric iron object found at Castaneda, in Switzerland. It was the handle of a thin bronze water-jug; the iron having been protected by the bronze from rust. The iron remaining gave on analysis:—carbon, 0.14-0.18; silicon, 0.005-0.08; sulphur, 0.012; phosphorus, 0.057; nitrogen, 0.008. It contained no manganese, cobalt, nor nickel, and was evidently made from ore free from phosphorus, sulphur, and manganese—in all probability from Elba. This is borne out by the fact that bronze must have been made from a tin-bearing copper ore such as was produced at the Etruscan mines of Campiglia Marittima, on the mainland opposite Elba. An examination of a polished surface of the iron etched with dilute hydrochloric acid, shows that the metal consists chiefly of a very soft almost pure iron, with harder portions where carbon has been taken up. The oxidation has followed the lines of admixed slag. It is evident that the iron has never been in a molten condition.

In Britain development was slow. External influences did not change so rapidly as on the Continent; and consequently the Britons adhered longer to their flint weapons and implements, in the manufacture of which they attained remarkable skill. Indeed, the old flint mines at Brandon, in Somerset, are still worked for supplying gun-flints to savage tribes. In Ireland the use of stone implements was continued well into historic times. Nevertheless, Britain possessed in tin a metal that was sought after by all the world. The tin trade was monopolized by Phœnician merchants until 300 B.C. Then came the fall of Phœnicia, and the Phœnician colonies fell into the hands of the Greeks. When Cæsar invaded Britain in 54 B.C., he found the inhabitants, owing to Greek influence, not entirely uncivilized, and carrying on an active tin trade with Gaul. Iron manufacture was carried on; and Cæsar states that for currency copper or gold coins, or iron bars of given weight, were used (*"Utun-*

tur aut aere, aut nummo aureo, aut taleis ferreis ad certum pondus examinatis pro nummo"). This passage has suffered much at the hands of transcribers; and many authors, including Dr. Percy, have accepted the reading "annulis," and have accounted for the total disappearance of the iron-ring coinage by oxidation. A fresh ray of light has been thrown on the matter by Mr. Reginald A. Smith, of the British Museum, who, in a paper read before the Society of Antiquaries in 1905, described a remarkable series of iron bars that were undoubtedly the money described by Cæsar. They roughly resemble swords with a rude handle in a square end, averaging 2 feet 7½ inches in length, and have often been found secreted in a manner suggestive of hoards of coins. Several specimens are preserved in the British Museum. There are three series all of similar form. In the first the weight is approximately 4770 grains, in the second the weight is double (9540 grains), and in the third the weight is quadruple (19,080 grains). A convincing proof of Mr. Smith's contention is afforded by the fact that there is preserved in the Cardiff Museum a bronze weight of 4770 grains found in a hoard of Late Celtic bronzes at Neath. It is of a common Roman form, cheese-shaped with "I" cut on the top. A similar weight, but made of basalt (4767) grains, is in the museum at Mayence. As these British currency bars do not date earlier than 400 B.C., their use must have been due to Greek influence. We know that the Spartan money took the form of iron bars; and even at the present day in Central Africa iron bars, spearheads, and other forms with uncomfortable spikes, are used as currency.

Mr. Smith's theory appears to me to be borne out by the weights of 26 spindle-shaped iron blocks found in 1866 at Monzenheim, and now for the most part preserved in the Museum at Mayence. These blocks are on an average sixteen times as heavy as Mr. Smith's unit weight of 4770 grains, or 309.74 grammes. Eight of them, including the heaviest and the lightest, gave the following weights:—4,000, 4,050, 5,000, 5,000, 5,120, 5,470, and 5,700 grammes. Apparently they are blooms made in the forest forges, of a weight suitable for currency; there being no decimal system of weights in those days, when the advantages of continual bisection were fully appreciated. The form was convenient for the smith, as he held the bloom at one end and forged one half. The blooms would be convenient to transport, as the smith could carry them as miners often do their drills, with a strap on his back and breast, horizontally, leaving his arms free. The purchaser, too, could easily try the pointed end in his forge, to ascertain the quality of the iron. Analyses of two of the British currency bars (A and B), made by Professor W. Gowland, and of a Monzenheim bloom (C) by Dr. Ludwig Beck, gave the following results:—

	A	B	C
Carbon	trace	0.08	0.43
Silicon	0.09	0.02	0.36
Phosphorus	0.69	0.35	0.24
Manganese	nil	nil	0.48
Nickel	0.23	nil	——
Sulphur	——	——	0.25

Bar A when examined microscopically showed no slag patches, and may have been an exceptional case of the use of meteoric iron, although it contains less than 6 to 10 per cent. of nickel usual in such metal. Bar B appears to have been produced by the direct reduction of Forest of Dean ore. The bloom C is a soft iron containing a considerable proportion of impurities.

The shape of the currency bars, one cannot help thinking, must have been chosen so as to enable the owner, if necessary, to convert his money into a sword. The spindle-shaped blooms, however, were of a form that was frequently adopted in early times. Even the iron blocks in the treasure-houses at Nineveh had a similar form; but the Assyrian blooms were all perforated, for convenience of transport, with a strap. It will be remembered, too, that in Sweden, the "Järnbåraland," or "mother-land of iron," as it was called in the seventh century, the Osmund blooms obtained in the peasant furnaces were broken into from 24 to 29 pieces each weighing a pound; and these Osmund pieces served as currency even in foreign countries from the beginning of the thirteenth century, and continued to do so until their export was forbidden by Gustavus Wasa. The copper-plate money to be seen at the museum at Falun, in Sweden, is a further example of the use of heavy masses of metal as currency. The largest, a 10-dollar plate, dated 1644, weighed no less than 43½ lbs.

The Roman influence in Britain was considerable and lasting, but the subjection was not complete until the year 84. When the Emperor Hadrian came to Britain. in 120, he founded an arms factory at Bath, using iron from the Forest of Dean; and the mines there were worked until the year 409. Indeed, the enormous heaps of slag left by the Romans furnished the chief supply to twenty furnaces for nearly 300 years. Similar slag-heaps have been found in Sussex and elsewhere. From explorations made within the Roman fortifications at Wilderspool, near Warrington, Mr. Thomas May has been able to deduce the form of furnace used; and he published in 1905 an interesting account of his remarkable discoveries. Association with Roman pottery, and with a hundred coins dating from 27 B.C. to 337 A.D., shows that furnaces found are of the latest period of the Roman Occupation, A.D. 410. The furnaces consisted essentially of a cavity with a wall and covering of clay, with holes in the base for admitting the draught and for withdrawing the metal. They were usually placed on sloping ground. The remains are of special interest, inasmuch as they show that coal was used with charcoal for smelting—fragments of cannel coal having been found, and that some of the iron was obtained in a molten state. Indeed, Mr. May considers that there is evidence in support of the view that an indirect method of producing cast iron in one furnace, and of converting it into malleable iron in another, was practised by the Romans at Warrington. Interesting as Mr. May's discoveries are, his interpretation of them is not convincing. There is no proof that either bellows or clay moulds for casting were used. The plant appears to have consisted of a roasting kiln, a smelting furnace, and a smith's forge. The fact that some coal was used may explain why some of the metal, like the minute specimen found, collected in a fluid state on the furnace bottom. The metal, as in the direct process carried out at Lagos, was essentially a natural steel, which by reheating was brought down to a malleable iron with a very low percentage of carbon. The process was somewhat similar to that described by Agricola, who makes no mention of cast iron. The passage translated by Mr. May, "From such ore, sometimes once, sometimes twice roasted, iron is *melted* suitable for being reheated in the smithy furnace," should read, "From such ore, once or twice roasted, iron is made, which is again made hot in the smith's forge and is flattened out under the hammer, which is lifted by a water-wheel and cut in pieces with the sharp iron." The analysis of the supposed cast iron, given by Mr.

May, is so remarkable that it is to be regretted that no microscopical examination of the metal was undertaken. It might even be found that the 1½-inch cube of metal described as cast iron was a furnace accretion composed of metal with unconsumed particles of charcoal, appearing in the analysis as graphitic carbon. Owing to roasting, the analysis of ancient irons presents great difficulties; and these are notably the case with cast iron. A cast-iron cannon ball, for example, recently discovered, in making the Paris underground railway, under the site of the old Bastille, whilst retaining its original shape, was found to consist chiefly of iron oxide. Its specific gravity was 4.854, instead of 7.6; and under the microscope it was found that the pearlite, which, in admixture with cementite, usually constitutes ordinary white pig-iron was oxidised throughout, whilst the cementite had preserved its metallic state. An analysis of the cannon ball by Mr. A. Portlier gave 5.9 per cent. of carbon, 0.25 per cent. of silicon, 0.75 per cent. of manganese, 2.9 per cent. of moisture, 72.0 per cent. of iron, and 17.45 per cent. of oxygen. The high percentage of carbon shows that some of the iron had been expelled; the original carbon percentage in the pig having probably been below 4. It is interesting to compare these results with the analysis given by Mr. May of supposed Roman cast iron, that had been subjected to oxidising influences for one thousand five hundred years. His figures are as follows:—Iron, 94.08; combined carbon, 0.23; graphite, 3.0; silicon, 1.05; sulphur, 0.48; phosphorus, 0.75; and manganese, 0.40 per cent.

In the early Middle Ages, although little progress was made in iron smelting, great advances were made in the manipulation of iron and steel. The sword was the triumph of the smith's art; but the manufacture of defensive armour called for skill of no mean order. The value of iron was, however, fully recognised. Writing in 1260, Bartholomew the English Franciscan, says: "Use of iron is more needful to men in many things than use of gold; though covetous men love more gold than iron. Without iron the commonalty be not sure against enemies, without dread of iron the common right is not governed; with iron innocent men are defended; and foolhardiness of wicked men is chastised with dread of iron. And well nigh no handiwork is wrought without iron; no field is eared without iron, neither tilling craft used, nor building builded without iron."

The invention of gunpowder, somewhere about 1310 to 1320, had a remarkable influence on iron manufacture; and it is interesting, in tracing the history of ordnance, to see the advances in the iron industry occasioned by the increasing demands of the artillerist. Although the first cannon of Berthold Schwarz were cast in bronze, it was not long before far more durable cannon were forged of iron bars hooped together; and the huge cannon such as Mons Meg (1455) at Edinburgh and La Dulle Griète at Ghent are remarkable examples of the skill in forging attained. The furnaces in which wrought iron was made at this epoch —the Catalan hearth, the Corsican furnace, the Osmund furnace, and the German Stückofen—are fully described in the historical treatises of Beck (5 vols., Brunswick, 1884-1903) and of Swank (Philadelphia, 1892), as well as in the standard metallurgical treatises of Percy, Bauerman, and others. From these furnaces, in which the metal was obtained in the malleable state in one operation, to the blast furnace, the transition was gradual. The basis of modern metallurgy was afforded by the discovery of cast iron, and by the employment of water-wheels, in the year 1323, for working the blast. The works were then removed from the forests to the river-valleys. Iron cannon balls were cast by Ulrich Beham in Memmingen in 1388; but cast-iron cannon are not mentioned before the fifteenth century. In 1412 two cannon, each 45 lbs. in weight, were cast for the town of Lille, and in 1422 cast-iron cannon were in use in the Hussite wars. The explanation of the late use of iron for castings is undoubtedly to be found in the unsuitability of the white pig-iron originally made. It was not until the height of the furnaces was increased that silicon could be reduced and grey pig obtained.

All the metallurgical operations of the ancients were entirely empirical. Nothing was known of the assaying ores. Colour and weight were the only indications of the quality of an iron ore. The idea of the transmutation of metals, which formed the aim of the chemical operations of the middle ages, did not go back to classic times. Geber, in the eighth century, was the first to recognise a metal as a fusible and malleable substance. He taught that all metals consist of sulphur and quicksilver in varying proportions. Alchemy did nothing to advance the iron industry; but there were besides the alchemists other philosophers who cared nothing for these things. Pre-eminent among these were Theophilus, the priest and monk, and Leonardo da Vinci, the artist. The former was a German who lived in the second half of the eleventh century. He was not only an author, but also a skilled worker in metals; and his book contains, besides the usual superstitions of the age, many practical observations, and gives a good idea of the workshop practice of a mediæval metallurgist. Leonardo da Vinci, who lived 300 years later, was not only a great painter and sculptor, but also an engineer and philosopher, with an astonishing knowledge of physics and mechanics. He developed the idea of the artesian well, and constructed deep boring plant, pumps, water-wheels, hydraulic presses, canals, and locks. He made a steam cannon, and had a dim idea of many other late inventions. His metallurgical knowledge was considerable. Among the many drawings left by him, one of a file-cutting machine is specially remarkable.

Georgius Agricola, who wrote the first systematic treatise on mining, living in Saxony, where no iron was worked, says but little about iron smelting. His illustrations show the increased height of the furnace; but he makes no reference to melting or casting iron. The subject of iron founding is, however, noticed by Lazarus Ercker in his work on assaying, published in 1574.

With the discovery of cast iron and the introduction of the blast furnace, the first stage in the history of iron closes with the end of the fifteenth century. Epoch-making inventions and discoveries soon followed. The introduction of coal as fuel for smelting by Dud Dudley in 1618, the replacement of coal by coke, the building by James Watt of the first blowing engine at the Carron ironworks in 1760, of puddling by Henry Cort in 1784, of the hot blast by Neilson in 1828, of the Bessemer process in 1856, of open-hearth steel making in 1861, and of basic steel making in 1879, are a few of the great improvements that have led to the marvellous development of the iron trade in this and other countries, and have rendered it possible for the world to produce, as it is now doing, 45 million tons of pig-iron annually.

THE WINDY ARM DISTRICT.

By J. J. Bell, Toronto.

The Windy Arm Mining District, in the Yukon territory, adjoining British Columbia, reports on which have appeared in the Mining Review from time to time, has a width of 3½ miles and a known length of 7 miles, in porphyry formation. It extends S. E. and N. W. but it is not known how far. It is, says Col. J. H. Conrad, unlike any other Mining Camp he

Camp at Montana Mine on Monarch Mt., Windy Arm, Y.T. Sept. 1st., 1905.

has ever been in. One can walk over the veins for miles. The ore instead of being in chutes is continuous. From 80 to 90 per cent of the values in most of the veins is silver, the balance principally gold. There are two veins where gold predominates.

At the Montana claim a drift has been run on the strike 250 feet, with a stope about 50 feet above the level. It passes through one fault but has been

Above Pooley's Canyon on Windy Arm. Sept. 1st., 1905.

found on the other side. The Mt. Hero, the next claim, has been opened up. The vein averages 36 inches.

About 100 claims were located in the summer of 1905 by prospectors, and sold for the most part to mining men with money on the ground. One prospector sold a four-fifths interest for $105,000, which was considered a small price. During the winter development work was going on and it is expected there will be a large influx this summer. One thousand men will be at work on the Conrad properties. Operations can be carried on all the year.

Pooley's Canyon showing location of Uranus Mine of the Conrad Group. Sept. 1st., 1905.

The White Pass Railway has surveyed the route for a branch from Cariboo Crossing to Conrad City, ten miles. It will be easy of construction, following the shore of the Arm all the way. It is to be built this summer.

The Montana Mine, which is 3,500 feet above the Arm and 5,800 feet above the sea, is connected with Conrad City by a winding trail 6 miles long and by an aerial tram 4¾ miles long. A stone house, 120 feet long, at the mine, furnishes accommodation for the workmen and stores.

The Montana Mine of the Conrad Group of Mines on Windy Arm.

A smelter will be built this season, probably at Conrad City. It will treat all the ores of the district, including the copper ores of White Horse and will have a capacity of 4,000 or 5,000 tons a day.

Construction of Aerial Tramway to the Montana Mine from Conrad City, Y.T. Sept. 1st., 1905.

Mr. W. Feet Robertson, provincial metallurgist of British Columbia, who is conservative in his opinions, says the Montana vein is the best he has seen since taking office seven years ago.

The accompanying views of the Windy Arm district will be of interest.

Bird eye View of Conrad City on Windy Arm, Y.T. Sept. 1st., 1905.

CORUNDUM IN QUEBEC.

The large bodies of corundum known to exist in the province of Ontario, have a prospective importance of much significance to the northern part of Quebec. Corundum in Ontario occurs in the nepheline syenite rocks of the Laurentian formation. It has been found in a belt of these rocks running through eastern Ontario for a distance of some seventy miles to the boundary line between the provinces of Ontario and Quebec, where the work of the government geologists ended. Mr. W. G. Miller, who examined the district with great detail for the Ontario Bureau of Mines, was necessarily limited in the field of his work to that province, and Dr. Adams and Dr. Barlow, who made an elaborate . investigation of the geological resources of the Hastings district for the Geological Survey, were confined to their particular map-sheets. The search for corundum, therefore, ended at the inter-provincial line, not because the deposits of that mineral, nor the peculiar rocks which contain them, were supposed to have all been found, but because the authority of the geologists making the examinations allowed them to go no farther.

On the other hand, the geological indications that the corundum belt extends into Quebec could hardly be stronger than they are without reaching actual proof. The great Laurentian formation, which forms the larger portion of the northern part of both provinces, is continuous from the county of Renfrew, in the corundum belt of Ontario, through the adjacent county of Pontiac, in Quebec.

Furthermore, Mr. Miller, in an article in the American Geologist, (Minneapolis, January 1901) announced that he had observed nepheline syenite, the characteristic corundum-bearing rock, at several places on the Quebec side of the boundary line, from Hull to Kippewa. There is, therefore, apparently, every reason to conclude that when corundum has been as carefully sought for in Quebec as in Ontario, the results may be equally successful.

It may also be noted in this connection that Dr. F. D. Adams has indicated in a recent paper in the Journal of Geology the probability of finding a large area of nepheline syenite somewhere on the north side of Lake Superior.

RAILWAYS AND MINING.

In a thoughtful and interesting speech before the Mining Institute, at the recent annual banquet in Quebec, Dr. James Douglas strongly emphasized the importance of the railway development of the country by railways, and especially of their necessity to the mining industry. (In effect, Dr. Douglas said, that the railway must precede the snbstantial establishment of a mining industry.) This he illustrated by detailed accounts from his own experience in Southwestern United States. In this connection it is interesting to note how several Canadian Mining districts have opened up as a direct result of the incoming of the railway. The development of the nickel deposits of Sudbury resulted from the building of the Canadian Pacific Railway; the Coal mines of the Crow's Nest Pass, from the incoming of that branch of the same road; the discovery of the remarkable deposits of silver, nickel and cobalt, at Cobalt, from the construction of the Temiskaming and Northern Railway, as has been commented on by Prof. Miller in a recent report; also the asbestos deposits of Thetford, in like manner, owe much of their development to the Quebec Central Railroad. Many other cases of similar import might also be mentioned. These, however, are sufficient to suggest, if suggestion is necessary, the great possibilities to be connected with the construction of the new Transcontinental Railway through Northern Ontario, Quebec and New Brunswick, and of the Grand Trunk Pacific through Northern British Columbia. This line, most of it through a new country, together with the many smaller lines, which will doubtless soon appear as feeders to it, must undoubtedly open a new era of development for the provinces whose natural resources are chiefly in their mineral wealth, as well as for the wheat fields of the prairie. Incidentally, too, it is for the Government to make known the possible resources of these districts through which the railway passes, as accurately and as promptly as possible.

MINING NOTES.

ONTARIO.

The cancellation of mining leases in Ontario goes on apace, one hundred being cancelled weekly during the month of April. These leases were situated in the districts of Rainy River North, Rainy River South, Thunder Bay, Algoma, and Parry Sound.

The Breton Coal Co. has ordered a 120 h.p. Robb-Mumford boiler for their new mine at Port Malcolm, C.B.

A by-law has been passed by The Mineral Range Iron Mining Co., Limited, changing its head office from the city of Windsor to the village of Bessemer, in the County of Hastings.

The Canadian Northern Railway is completing its arrangements for a branch line into the Atikokan iron range. The mine is now equipped with buildings and machinery, and operations have commenced, so that ore will be ready to be shipped so soon as the C. N. R. is in a position to carry it.

A blast furnace, capable of producing 200 tons of pig iron per day will, it is expected, be built shortly on the Niagara Peninsula. The gentlemen connected with this venture are said to be also interested in the Canada Foundry and Canadian General Electric Companies. It is said that the capital of the company will be $1,000,000.00.

The Canadian Goldfields Syndicate, Limited, has declared a dividend of 1¾ per cent. on its $600,000 of issued capital stock. The dividend is for the quarter ending March 31, and is payable May 1. The dividend amounts to $10,500, and the total of its dividends to date is $93,000. The Canadian Goldfields Syndicate is the owner of 4,260 shares of the Consolidated Mining and Smelting Company of Canada, Limited, which at the present valuation of the shares is equal to about $600,000.

The Dominion Gold Mining & Reduction Company's works, at Kenora, were recently destroyed by fire. The works comprise a 20 stamp mill, cyanide and chlorination buildings, valued at between $20,000.00 and $30,000.00. No insurance was carried. The works were built by Messrs. Powers and Linn, who subsequently sold them to the Dominion Gold Mining and Reduction Works Company, in which many local men were interested.

According to the Portland, Oregon, *Telegram*, Dr. David T. Day, chief of the division of Mining and Mineral Resources of the United States Geological Survey, has found platinum to exist in paying quantities in sands brought from the Hootalinqua, Y. T. Should these reports be verified, it may well be that the platinum in these sands will be well worth mining for on a large scale. The present price of platinum is very high, and the demand exceeds the supply.

Principal Galbraith, of the School of Practical Science, Toronto, gave a very interesting address recently before the Canadian Institute, on "The Microscopic Structure of Iron and Steel," illustrating his remarks by the aid of lantern slides. He touched upon the testing of iron and steel, describing briefly both the chemical and physical methods. The speaker gave credit for the first micorscopical examinations to Dr. Sorby, of Berlin, whose initial experiments were carried out in 1864. Notwithstanding the Doctor's undoubted success, his first paper on the result of his examinations received but scant attention; later the soundness of his deductions was verified, and the system he advocated is now in use everywhere.

Professor Galbraith's address was well received, and was pronounced by all those present to have been one of the most interesting ever delivered before the members of the Canadian Institute.

NOVA SCOTIA.

The Warren Creek Copper Company at Spillimachene has recently changed hands. Development work will probably be started at once.

An occurrence of molybdenite in important quantities is reported from the Upper Gatineau region. The location is in the Township of Egan, about 80 miles from the Ottawa River, and the indications for the mineral are said to be promising.

Mr. John Macintosh, of Ottawa, is reported to have recently bonded the well-known Union Asbestos Mines of Black Lake. These mines, commonly known as the Wertheim property, have been controlled by German capitalists for several years. The milling plant has a capacity of 100 tons per day, and the property has been vigorously worked for several years past, under the efficient management of Mr. T. H. Crabtree.

The first mining claim to be staked out on Hudson Bay has just been registered with the Dominion Government by Mr. William Beech, of Winnipeg. Mr. Beech has discovered, in the vicinity of Fort Churchill, deposits of mica, iron ore and graphite, which are the cause of his making the location. Gold and copper are also reported from the same region, and Mr. Beech intends to do further prospecting in the Hudson Bay region during the early summer.

Considerable improvements are being made at the Reserve mine, Cape Breton, which look toward an increased output at that mine. In the boiler house two Babcock-Wilcox boilers have been installed. Each boiler has a capacity of 250 h.p., which, together, will make up a total capacity of 1,800 h.p., an increase of about 40%. The compressor plant has also been enlarged, so as to give a capacity of 10,000 cubic feet of air per minute. A hoisting engine of 100 h.p. has been installed on the Emery seam.

The following are the figures of the German consumption of foreign copper for the months of January and February, 1905 and 1906, as given by L. Vogelstein & Co., 90-96 Wall Street, New York, agents for Aron Hirsch & Sohn, Halberstadt, Germany:—

	1906	1905
Imports	22.770 tons	15,884 tons
Exports	2,509 "	1,937 "
Consumption	20,261 "	13,947 "

Out of the above 16,968 tons were shipped from the United States.

The Crow's Nest Pass Coal Company has paid its second dividend for 1906, the first having become paid on January 1. The dividends, which are looked for quarterly, have thus far amounted to $87,500.00. The output of coal (for the month of March) from the Company's mines was 81,273 tons. The highest previous record was made in January of this year when the output reached 73,303 tons. The March output was divided amongst the three principal collieries as follows:—

Coal Creek	43,701 tons.
Michel	29,667 "
Carbonado	7,904 "
	81,273 tons.

The coke production for the month was 25,451 tons, which is considered a very satisfactory record.

BRITISH COLUMBIA.

A. H. A. Robinson has been appointed inspector of mines for the Temiskaming district.

It is announced that in consequence of the advance in the price of arsenic the Deloro mine, in the County of Hastings, once a large producer, is to be operated again.

A large deposit of foundry sand has been found on the farm of H. J. E. Wilcox, near Niagara Falls. Much of the silicious sand used hitherto has been imported.

Work has been commenced on mining location J.E.S. 22, Lake of the Woods, and ore yielding $8 to the ton is being taken out. The owners claim to have the Sultana vein.

Considerable activity is being shown at the Canada Corundum Co.'s works at Craigmont. The output is about 300 tons a month.

In the April number of the Review a reference was made to the deposit of sodalite near Bancroft. A car load recently sent to Great Britain is said to have netted $30,000.

The Government of Ontario has announced its intention to appoint a Provincial Assayer, who will be an official of the Bureau of Mines.

Hon. F. Cochrane, Minister of Lands and Mines, has given his decision in the dispute over the ownership of the Velvet mine, in favour of J. O. Handy, of Pittsburg, who has been in possession and working it for some time.

Active operations were commenced April 1 at Windy Arm, B.C., by the syndicate of which Mackenzie & Mann are prominent members. Supplies have gone in, and about $20,000 a month is being spent in development.

The Consolidated Mining and Smelting Company of Canada, Limited, operating under a Dominion charter, has been licensed to do business in Ontario. W. D. Matthews, president of the company, is its authorized attorney.

A gold mine on the farm of John Rhodes, in Elzevir Township, County of Hastings, is being operated by a Buffalo syndicate. A shaft has been sunk 70 feet, and a 20 ft. vein opened up, which is said to assay $130 to the ton.

The new board afterwards held a meeting and elected the following officers: W. E. Gosnell, president; S. M. Brydges, vice-president; F. W. Swannell, secretary; F. E. Morrison, treasurer.

The North Star mine recently made a shipment of 448 tons in one week, thus bringing the production for the year up to 1,500 tons, in round numbers. The Aurora has also entered the shipping list. The total shipments of silver-lead ores for Southeast Kootenay seem to be steadily on the increase.

The Act to reorganize the Department of Lands and Mines for Ontario is now in force. The Department presided over by Hon. Frank Cochrane will henceforth be known as the Department of Lands, Forests and Mines. It will have two deputy heads; Aubrey White having supervision of lands and forests, and T. W. Gibson, late director of Mines, of the Mining Branch.

The B. A. Pyrite mine, at Queensboro, Ont., which was shut down for a month while a compressor was being installed, is again working, and shipments of two or three cars a day are being made. The compressor has a capacity of four drills with provision for four more. Hoisting and other machinery have also been added.

Nelson.—It is reported on the authority of Mr. Turner, of Spokane, that the Sullivan mine at Marysville, East Kootenay, made a profit of $17,000.00 last month. The shipments from the Sullivan for the week ending April 14th, were 500 tons, and for the year thus far 6,920 tons. The Sullivan is the largest producer in the district, next to the St. Eugene.

Lardeau.—Some important development work was done during last season on the Grand Solo group, which consists chiefly of two claims near the head of Canyon Creek. Development consists of a drift of 125 feet along a four foot ledge, which has a pay streak of 22 inches of quartz and grey copper. One streak of four inches is said to carry 1,500 oz. of silver and 12% of copper.

The Bruce Copper Mines, which recently passed into the hands of the Copper Mining and Smelting Co. of Ontario, composed principally of English capitalists, are about ready to start work, after a four year close down. It is understood that a smelter is to be built. The Ontario Legislature will be asked to pass an act to validate a by-law of the municipality, fixing the assessment of the property for a period of ten years.

The fifth annual meeting of the Similkameen Valley Coal Company was held recently at Nelson. The reorganization of the Company was proceeded with. The former board of directors was retired by resolution and the following gentlemen were duly elected to the positions thus made vacant: W. E. Gosnell, S. M. Brydges, F. E. Morrison, G. Tierney, H. G. Goodeye, I. G. Nelson and F. W. Swannell.

Kootenay.—The Canadian Metal Company has bonded the Giant mine at Spillimachene. This is a low grade zinc and silver-lead property, having a large amount of ore developed. The ore body is about 200 feet in width, and is exposed for about 400 feet. The ore will be mined by quarrying, a concentrator built, and the concentrates shipped to the company's smelters at Frank and Pilot Bay. The property is valued at $100,000.

Advices from Northport state that the Le Roi smelter will resume operations on May 1st. A considerable amount of custom ore is said to have been promised the smelter from mines in the vicinity. As much of the ore which goes to Northport has to be roasted, the time required for this operation (as well as for the accumulation of a reasonable reserve before beginning work) will probably cause some time to elapse before the furnaces are actually blown in.

The Canada Gold and Hydraulic Dredging Co., in which a number of Toronto people are interested, obtained recently a British Columbia charter, and the right to operate on the Fraser River, where they have secured three claims opposite Cayoosh Creek. These claims extend 1,500 yards on the face and run back 700 yards and go two feet below low water mark. The Iowa Company is operating the adjoining property and paying handsome dividends.

At a meeting of the Engineers Club of Toronto, a paper on the Electrical Production of Iron and Steel, by J. W. Evans, of Deseronto, was, in the absence of the author, read by Prof. G. R. Mickle. At its close the conclusions arrived at were severely criticised by Mr. Samuel Groves, editor of the *Canadian Engineer*, who declared them to be wholly fallacious. A lively discussion ensued. Mr. Evans does not think that on the ground of economy the electric furnace can as yet compete with the blast furnace.

The Moose Mountain iron deposit, to which the James Bay Railway is being extended, is said to be one of the largest and best known. It was not intended to build the railway north of Sudbury at present, but a personal inspection by D. D. Mann led to an agreement with the Moose Mountain Mining Co. to extend the road to a point 25 miles north, with a spur to the mine. A short line will also be built from the vicinity of the crossing over French River to some point on the Georgian Bay, probably The Key, where there is a good harbour.

The Ontario Government has determined to appoint a Mining Commissioner, who will be free from political influence, and relieve the Minister of Lands, Forests and Mines of work which now takes up much of his time. The Commissioner will hear appeals from the findings of inspectors and mining recorders, disputed claims, etc., visiting the localities involved when necessary, and obtaining information by personal inquiry and observation. His work will be largely judicial. Appeals from his rulings to the Divisional Court at Toronto will be possible.

The Thorold Natural Gas Co., incorporated some time since, has been prevented from carrying on operations by the action of the St. Catharines Natural Gas Co., which obtained an injunction to prevent an agreement entered into with the Niagara Peninsula Co. from being carried out. The Thorold Co. had agreed to take over the pipe line to, and the services in Thorold, and to supply that town with gas, but in consequence of the injunction has, beyond becoming incorporated, done no business. In the meantime, though the pipes are laid, Thorold is without natural gas. The matter may come before the courts.

Boundary.—The monthly statement of the Granby Consolidated, for March, shows some interesting figures in its cost sheets. Its mining costs were 3.76 cents a pound; freight 1.18 cents; smelting 6.64 cents; general expenses ·72 cents:—total 12.2 cents; foreign ore cost 1.08 cents, making a total cost 13.28 cents a pound. Deducting gold and silver values of $6.94 the net cost of the smelter in British Columbia was $6.34. The cost landed in New York was 8.34 cents, and the profit for the month 9.71 cents per pound on the copper output. The present monthly output may be stated at 1,750,000 lbs. of copper 30,000 oz. of silver, and 5,300 oz. of gold.

While excavating for the compressor a new vein, six feet wide, of rich ore was struck. This will be followed up. Inquiries have been received from a number of places, including Glasgow, Scotland, for the ore. The company has shipped 750 tons to Buffalo, and more is demanded. The company expects to be shipping ten car loads a day within a year. A survey has been made for a spur line of the Bay of Quinte Railway to the mine. It is in contemplation. The installment of an electric plant is one of the probabilities of the future, as water power about three miles distant being available. The company expects to open up other pyrites mines in the Hastings district as the demand for their product is growing.

Mr. E. T. Corkill, inspector of the Bureau of Mines for Ontario, is responsible for the following:—In the Lake of the Woods district four mines are working—the Sultana, Bully Boy, Combine, and Olympia. The Sultana's is the only stamp mill running. At Gold Rock, Upper Lake Manitou, extensive works are being put in at the Laurentian mine. The stamp mill is about ready to go into operation. The reports which have found their way into the newspapers about seams of gold three inches thick at this mine are, of course, very much exaggerated. The Paymaster, Little Master and two or three others are getting in machinery. On Eagle Lake the Eldorado is working on development, and has a two stamp mill.

A suit of some interest, in which the Mines Contract Co. is plaintiff and the Great North West Mining Co. is defendant, is before the courts. The plaintiffs sold to the defendants a number of claims, taking part in cash and part in paid-up stock, and undertook to act as agents for the defendants. Certain moneys were also advanced. In consequence of disagreements among the defendants these sums have not been repaid, and action was brought to obtain a settlement. Among the properties handed over was the Indian Joe mine, four miles north of the Mikado, on the Lake of the Woods, where defendants have about 2,000 tons of ore on the dump, and a full equipment of machinery, and were arranging to put in a forty-stamp mill when the difficulties arose. The matters in dispute have been allowed to stand till the annual meeting of defendants company, when it is hoped an arrangement will be arrived at.

According to the Fernie *Free Press* of April 27th, the payroll of the Crow's Nest Pass Coal Company for March was as follows:—

Coal Creek mines	$67,472.70
Fernie ovens	6,709.00
Michel	52,422.95
Carbonado	12,549.20
M., F. & M. Ry	2,210.70
Wardrop	1,341.40
Total	$142,705.95

This pay roll is considerably in the lead of the previous record. The highest sum reached in 1905 was in July, when the pay-roll was $134,278.40.

Trail.—The lead returns of the Trail smelter for March show an increase in the total shipments, but a reduction in the number of shippers. The returns are as follows:—

Mine.	Ore, Lbs.	Lead, Lbs
American Boy	37,988	15,369
Lone Bachélor	73,542	33,818
North Star	772,610	297,970
Rambler	41,209	1,854
St. Eugene	3,341,250	1,936,672
Total	4,266,799	2,285,683

Rossland.—Shipments from the Rossland camp for the week ending April 7th, were as follows:—

Centre Star	3,000 tons.
Le Roi	2,400 tons.
Le Roi No. 2	530 tons.
Le Roi (milled)	1,200 tons.
Total for the week	7,140 tons.

and for the year, 84,065 tons.

BOOK REVIEWS.

We are in receipt of a copy of the 6th edition of "A Treatise on Ore and Stone Mining," by Foster, revised and enlarged by Bennett H. Brough. When the fifth edition of this standard work was published in the spring of 1904, Sir Clement Le Neve Foster stated that he had made good a few defects, but that he hoped to re-write the work before another edition should be required. This hope was destined not to be fulfilled, as the author passed away very shortly after he had penned these words. The new edition was brought out under the editorial supervision of Mr. Bennett H. Brough, and he is to be congratulated upon the very excellent and careful work he has put into it.

The book is so well known to mining men that nothing would be gained by a detailed review of its contents, suffice it to say, that the additions and illustrations describing recent changes and improvements in the mining industry have been considerable, and such, as it is believed, the author himself would have made had he survived to carry out the work. An especial attempt has been made to include comprehensive information that would be useful to mining engineers in distant regions, where reference libraries are not accessible. The main divisions of the work are; the occurrence of minerals, boring, breaking ground, supporting excavations, exploitation, haulage, hoisting, drainage, ventilation, lighting, access, dressing, legislation, condition of the miner, accidents and the principles of employment of mining labour—from which it will be seen that the scheme of the work is ambitious. It should be on the shelves of every mining engineer. This book is published by Messrs. Charles Griffin & Co., London, the price being thirty-four shillings sterling.

COMPANY MEETINGS AND REPORTS.

At the April meeting of the directors of the Granby Consolidated, held at the company's office New York City, a three per cent. dividend was declared on the outstanding shares of the company, which amount to 1,350,000 shares. This makes the dividend equal to that paid in January, namely, $405,000. No statement was given out as to whether this is a semi-annual or a quarterly dividend. The dividends thus far paid by the Granby are as follows:—

December 16th, 1903	$133,630.00
January 15th, 1906	405,000.00
May 15th, 1906	405,000.00
	$943,630.00

It is intimated that, by the end of the current year, the Granby will have raised its output to 2,800,000 lbs. of copper per month.

Notice has been received of the declaration of a dividend by the directors of the Consolidated Mining and Smelting Company of Canada, Ltd., for the first quarter of the year 1906. The dividend is 2½ per cent. The directors state that it is one of a series of quarterly dividends that will be paid at the rate of not less than 10% per annum. The Consolidated Mining & Smelting Company is reported to be in good condition, inasmuch as it does not depend on any single mine, or upon any single mining district, but "its interest and business is so diversified as to minimize, as far as possible, the speculative element." A policy of the company, which will do it much good in the future, and which should expand its sphere of operation and increase its dividends, is to acquire new properties where they have been favourably reported on by reputable experts.

DALHOUSIE UNIVERSITY SUMMER SCHOOL OF MINING.

The Summer School of Mining of Dalhousie University began its session of 1906 on Saturday, April 28th, at Clementsport, Digby Co., N.S. It will last for five weeks, closing at Stellarton, Saturday, June 2nd. The students of the third year in Mining Engineering at Dalhousie are accompanied by Profs. J. E. Woodman and F. H. Sexton. The first ten days will be spent in geological field work in the Bear River Basin, correlating other parts of the Basin with the sections on Bear River surveyed by the Summer School in 1904. Iron ore deposits are to be studied at Torbrook, Nictaux, Brookfield, and Londonderry. Blast furnace practice, foundry work, open hearth manipulation, and rolling mill methods will be observed in Londonderry and Ferrona. Gold mining and milling will be studied in various camps—Caribou mines, Harrigan Cove, Isaac's Harbor, Seal Harbor, and Forest Hill. Coal mining methods will be examined in Stellarton, Westville and Thorburn.

A USEFUL MACHINE.

Recognizing the need of a portable blacksmithing forge suitable for prospecting parties going into the bush, Messrs. W. H. C. Mussen & Co., of Montreal, have put in stock a new compact and light-weight fan forge which is entirely enclosed in a stout sheet iron casing having no projecting parts.

This outfit is a new departure and is designed to meet the requirements of Railroad and Bridge Contractors, as well as Prospectors. The latter will find the smaller size very convenient as it measures only 18″ high and has a hearth 18″ x 18″ and weighs only 94 lbs. In addition to this the design is such that breakage is practically impossible. This feature we feel will particularly appeal to those engaged in outdoor work, as so many of the Forges now in use are easily broken through being up set or being struck by some article. The fan arrangement of the Blower is similar to the general type and the lever is direct connected to the 12″ fan, which gives a powerful and steady draft.

This forge can be put in a canoe, packed on the back, or on a mule, or otherwise transported without difficulty or damage. It is warmly commended to the attention of prospectors and others.

NOVA SCOTIA MINING.

A considerable number of areas were taken up during the month of April, particularly in the Wagamatkook District.

The following is a summary of areas applied for during month:—

District.	Areas.
Lawrencetown	45
Millers Lake	94
Liscomb Mills	12
Harrigan Cove	71
South Uniacke	12
Wagamatkook	409
Voglers Cove	16
Leipsigate	15

Gold River	5
Mt. Uniacke	15
Ovens	12
Cow Bay	37
Stormont	117
Lochaber	16
Brookfield	35
Whycocomagh	60
Renfrew	6
Shelburne	66
Waterville	12
Salmon River	73
Montague	2

The only crushings to hand for the month are as follows:—

Mill.	Tons	oz.	dust	grs.
Oldham Sterling Gold Co.—Oldham District	160	212	0	0
J. A. Crease Mill—Mt. Uniacke	29	21	5	0

THE DOMINION COAL COMPANY'S OUTPUT.

The output of the Dominion Coal Company for the month of april was as follows:—

No. 1 Colliery	47,957
" 2 "	48,697
" 3 "	30,802
" 4 "	43,995
" 5 "	55,472
" 6 "	6,499
" 7 "	14,487
" 8 "	15,872
" 9 "	32,636
Total	296,417 tons

Shipments; 203,349 tons.

THE MINING AND INDUSTRIAL SHARE MARKET

(Specially reported for the Canadian Mining Review, by Robert Meredith & Co., Mining Brokers, 57 St. Francois Xavier Street, Montreal.)

The prices of mining stocks have been receding during the past few days. Transactions have not been large; but the demand has been largely withdrawn, owing to the fact that it has been impossible to procure any fairly large amounts of stock by bidding.

The Mining Exchange has experienced considerable difficulty in forming a list of stocks which will receive official sanction, from the fact that popular favor seems to be turning to the Cobalt stocks, and these stocks are as yet little known.

British Columbia properties are improving and there is more "*bona fide*" mining going on in that province than ever before, but the public interest is not at present centered on British Columbia.

Industrial shares have been fairly active, but on comparing prices with those obtaining last month, it is found they are in the main a shade lower. This is due to their being mostly of a speculative character, and are, hence affected, by the money market, which of late has been stringent.

The latest quotations are as follows:—

	Bid.	Asked.
Can. Consolidated Mines	130	13 2
Can. Gold Fields	7	7¼
Granby Consolidated	13	13¼
Rambler Cariboo	32	34
North Star	03	05
Monte Cristo	2	3
White Bear	1½	2½
California	1½	3
Virginia	2	5
Deer Trail	1½	2¼
International Coal	34	36
Sullivan	2	3¾
Jumbo	23	25
Cariboo-McKinney	1½	—2½
Dominion Coal. (common)	74	77
Dominion Coal. (preferred)	116	119
Dominion Iron & Steel. (common)	28¾	29
Dominion Iron & Steel (preferred)	74½	77
Intercolonial Coal (common)	80	86
Intercolonial Coal (preferred)	98	100
Nova Scotia Steel & Coal	62	63¼
Nova Scotia Steel & Coal (preferred)	118	120

THE ELECTRIC SMELTING OF IRON.

The Engineering supplement of the London *Times*, published recently a criticism upon the electric smelting of iron, as reported by the Canadian press. Referring to Dr. Haanel's experiments at Sault Ste. Marie, it said:

A considerable amount of glorification appeared to be manifested in the Canadian press on account of the success of Dr. Haanel, Canadian Superintendent of Mines, in turning out some 50 tons of pig iron by electricity. It is stated that the following (among other) facts have been fully established by the experiments at Sault Ste. Marie:—

1. Canadian ores, chiefly magnetite, can be economically smelted by the electro-thermic process.
2. Ores of high sulphur content can be made into pig iron containing only a few thousandths of sulphur.
3. The sillicon content can be varied as required for the class of pig to be produced.
4. Titaniferous iron ores containing up to 5 per cent. can be successfully treated by the electro-thermic process.

We are informed that the consequence of the recent electric smelting operations would be "that Canada can undertake for itself the iron and steel industry, and will not in future have to import coal or ore for that purpose; that Canadian Manufacturers will make from Canadian products tools and agricultural implements, build bridges, boats, and railways, and make the machinery to be used in thousands of busy factories." Without the slightest wish to decry the value of Dr. Haanel's researches, it may be pointed out that the premises are rather slender for the bold assumptions contained in the foregoing and other newspaper articles. Dr. Haanel, we believe, has no practical acquaintance with steel manufacture, and, although an able man in his own sphere—that of a pure physicist—would find great difficulty (at all events, anywhere away from Canada) in obtaining any credit as an authority on the manufacture of iron or steel. There is no doubt that something on a large and, perhaps, even a commercial, scale will be set on foot in Canada for the electric smelting of ores. It is stated, in fact, that the Lake Superior Power Corporation have decided to acquire the Government plant for the purpose of converting their stock of briquetted ore into marketable ferro-nickel pig. But altogether it may be said that the experiments so far have been conducted on much too small a scale to warrant any definite conclusion as to the results of a trial on an actual commercial basis.

THE SILVER MARKET.

Most notable features in the Market for bar silver in the last year was a steady increase in price, until, on December 20th, silver was sold in New York as high as 66 cents troy ounce and the London quotation reached 30 5-16d a standard ounce. This was the highest price obtainable for silver since 1896. There has, however, been a steady improvement in price during the last four years. The average New York quotation for 1902 was 52.16 cents an ounce; for 1903, 53.57 cents; for 1904, 57.32 cents, and for 1905 the average will exceed 60 cents. The lowest monthly average in 1902 was 49.07 and the highest 55.56. In 1903 the lowest monthly average was 48.72 and the highest 60.37. In 1904 the lowest overage was 53.43 and the highest 60.56. In 1905 the lowest monthly average was 56.60, and the average for the month of December will exceed 65 cents. Increased wealth and population of the world are continually requiring increased coinage of silver, both for countries using silver alone and for subsidiary coinage of so-called gold countries. In the last ten years consumption of silver in arts and manufactnres has increased from about 16 per cent. of the world's production to 30 per cent. The result has been a consumption of silver in the last year largely in excess of production, and as no stocks of bar silver are held or have been held in any market for several years, this over consumption has been supplied by denuding silver using countries of their coinage. In the last few months there has been sold from the Mexican circulation and Mexican reserve held against paper circulation probably $20,000,-000. This seems to indicate that the Mexican Government intends to issue gold certificates to take the place of currency, which must be retired through sale of silver dollar reserves. So long as this process continues and this supply is upon the world's market at approximately the currency ratio adopted by Mexico, namely 50 cents gold for a silver dollar, the silver market cannot advance too much, if any, beyond the present market price of 65 cents to 66 cents; but as soon as this supply is exhausted or withdrawn from the market there seems no reason to doubt that the price prevailing before the closing of the India mints can be confidently expected.

SUMMER SCHOOL OF MINING, McGILL UNIVERSITY.

The Summer School of Mining of McGill University opened on April 19th, and will be conducted chiefly in the mining districts of Nova Scotia. The class, which is a large one, will first visit the gold mining region of Oldham, N.S., after which the coal district about Sydney will be studied with some care, and a visit made to Newfoundland. The party is in charge of Dr. Adams and Dr. Porter. The entire trip will occupy about six weeks.

MINING INCORPORATIONS.

ONTARIO AND QUEBEC.

"Coppers Limited." Capital, $2,000,000.00, in shares of $100.00 each. Head Office, Montreal.

Canadian Yukon Mining Company, Limited.—Capital, $100,000.00, in shares of $10.00 each. Head Office, Toronto.

International Gold Dredging Company, Limited.—Capital, $1,000,000.00, in shares of $100.00 each. Head Office, Ottawa, Ont.

Wonderland Silver Mining Company, Limited.—Capital, $250,000.00, in shares of $1.00 each. Head Office, Windsor, Ont. Provisional Directors: Messrs. Frank Shoonmaker, Edmond Peabody, William Stone, Halda Irish and Elias Sellers.

The Mines Publishing Company, Limited.—Capital, $40,-000.00, in shares of $50,00 each. Head Office, Toronto. Provisional Directors: Messrs. John Michael Ferguson, James John Harpell and James Edward Day.

The Sterling Silver Cobalt Mining Company, Limited.—Capital, $600,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Joseph Gonder Beam, John Robertson and Thomas Ernest McCracken.

The Silver City Mining Company, Limited.—Capital, $350,000.00, in shares of $1.00 each. Head Office, Windsor, Ont. Provisional Directors: Messrs. Harry Sydney Pritchard, John Lewis and Frederic Watt.

The Florence Mining Company, Limited.—Capital, $100,-000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Messrs. Harry Sydney Pritchard, John Lewis and Frederic Watt.

Cobalt Silver Queen, Limited.—Capital, $1,500,000.00, in shares of $1.00 each. Head Office, Cobalt, Ont. Provisional Directors: Messrs. Francis Robert Latchford, Frank L. Culver and Robert Wm. Gordon.

Silver Horn Mining Company, Limited.—Capital, $50,000.00, in shares of $50.00 each. Head Office, Toronto. Provisional Directors: Messrs. Alfred Bicknell, James William Bain, Gerard Brackenridge Strathy, Leigh Clow Todd and Joseph Edward Riley.

Cobalt Townsite Mining Company, Limited.—Capital, $100,000.00, in shares of $1.00 each. Head Office, North Bay, Ontario. Provisional Directors: Messrs. Jno. Mackay, Rupert Simpson, Alfred James Young, Andrew Santerre, Clement Albert Foster and Geo. Taylor.

The Douglas Milling Company, Limited.—Capital, $40,-000.00, in shares of $10.00 each. Head Office, Douglas, Ont. Provisional Directors: Messrs. John Knight, Charles McGaghran, Silas Shaver Stitt, Thomas Monaghan Thrasher, Alex. McEachen and Owen Enright.

The Silver Bell Mining Company, Limited.—Capital $250,-000.00, in shares of $1.00 each. Head Office, North Bay. Provisional Directors: Messrs. John William Richardson, Thomas Charles Begg, Edgar Brandon, Arthur Cecil Rorabeck and Geo. Brown McConachie.

The Silverland Development Company, Limited.—Capital, $1,000,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Edwin James Hardy Pauley, Ernest Reginald Clarkson, Blanche Bishop Pauley, Colonel Wm. Wylie Rice and Frederick Ashdown Fenton.

Montreal Cobalt Mining Company, Limited.—Capital, $500,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Messrs. Hamilton Bender Wills, Whitford Vandusen, Wm. David Scott, John Charles Colling and John Samuel Humberston.

The Shakespeare Development Company, Limited.—Capital, $300,000.00, in shares of $1.00 each. Head Office, Sault Ste. Marie, Ontario. Provisional Directors: Messrs. James Miller, Harry William Evenden, Wm. Howard Hearst, John McKay and James Leland Darling.

Peterson Lake Silver Cobalt Mining Company, Limited.—Capital, $3,000,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Messrs. Bartle Edward Bull, Joseph Montgomery, James Geo. Shaw, James Graham Strong and William Roland Williams.

Star Silver Cobalt Mining Company, Limited.—Capital, $2,000.000,00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Messrs. John Meen, John Arthur Shaw, Joseph Montgomery, William Roland Williams and Bartle Edward Bull.

BRITISH COLUMBIA.

Bear Hydraulic Mining Company, Limited.—Capital, $250,000.00, in shares of $1.00 each.

The Canada Gold Hydraulic and Dredging Company, Ltd.—Capital, $250,000.00, in shares of $1.00 each.

The Canada Mine and Smelter Supply Company, Limited. Capital, $150,000.00, in shares of $1.00 each.

The Islands Copper Company, Limited.—Capital, $1,000,-000.00, in shares of $1.00 each.

Prince Henry Mining Company, Limited.—Capital, $500,-000.00, in shares of $1.00 each.

MINING MEN.

Mr. A. J. MacMillan, Managing Director of the Le Roi, has recently returned to Rossland from London.

Dr. A. W. G. Wilson, who for the past four years has been senior demonstrator in geology at McGill University, has severed his connection with that institution, in order to devote his time to his private practice as Mining Geologist, etc. Dr. Wilson's address is 197 Park Avenue, Montreal, Dr. Wilson will spend the summer in investigating the economic geology of regions lying between the line of the Transcontinental Railway and James Bay, in which work he will be assisted by Prof. John A. Dresser, of Montreal, whose thorough knowledge of the Huronian System in the Eastern Townships will be of great value to Dr. Wilson.

COAL NOTES.

The following were the Dominion Coal Company's output and shipments for March, 1906:—No. 1, 47,748; No. 2, 53,557; No. 3, 32,612; No. 4, 48,186; No. 5, 60,120; No. 6, 7,632; No. 7, 13,567; No. 8, 14,367; No. 9, 32,431. Total output, 310.220, The shipments were 178,182 tons.

CONNORS v. DOMINION COAL COMPACY, LIMITED.

The action in this case was brought against the Company by an employee for retaining wages due, the latter owing money at the Company's store. The decision was given by Magistrates J. J. MacDonald and Hector McDonald, of Glace Bay, in favour of the plaintiff, and a minimum fine, $50.00, was imposed on the Company. It is understood the company will not carry the case to a higher court. This is the first case that has been decided against the Dominion Coal Company.

INDUSTRIAL NOTES.

A number of machines of similar capacity are being built by The Westinghouse Machine Company for large power houses in New York, Brooklyn, and other cities.

The Jenckes Machine Company, Limited, of Sherbrooke, Que., has recently shipped a 250 h.p. electric hoist to the Granby smelter at Phœnix, B.C.

The Alaska Treadwell Gold Mining Company, Treadwell, Alaska, recently ordered a 20 x 48 double drum, direct acting hoisting engine from the Allis-Chalmers Company, Milwaukee.

The infringement, which formed the basis of this suit was the using of Sheefer Alternating Current integrating wattmeters manufactured by the Diamond Meter Company of Peoria, Ill. This is the same patent on which E. B. Latham & Company of New York City, dealers in Sheefer Wattmeters, was enjoined on November 4th, 1905.

The Sullivan Machinery Company, of Chicago, which was one of the sufferers by the recent upheaval in San Francisco, has now opened temporary offices at 1010 Washington Street, Oakland, Calif. Far from being daunted by the recent disaster, they will now carry an increased stock of rock drills and air compressors, together with the separate parts of these machines. The manager is Mr. H. T. Walsh.

The Westinghouse Machine Company, during the months of February and March, received orders for 35 steam turbines aggregating approximately 50,000 Brake Horse Power capacity, to be used by transportation companies chiefly.

The largest is of 7,500 K.W. capacity, or 11,000 Brake Horse Power, and will be installed by the Transit Development Co., of Brooklyn.

The United States Circuit Court for the Northern District of New York, a few days ago, filed a decree enjoining the defendant in the case of the General Electric Company vs. the Madison County Gas & Electric Co. from using alternating current integrating wattmeters or other motor devices embodying a provision for securing an approximate 90 phase adjustment by induced circuit.

We are in receipt of one of a series of fifty multichrome cards, giving views of Swiss scenery, which the Allis-Chalmers Company are sending to their customers, as an advertisement of the Schindler Bolting Cloth, which they furnish to millers. These views are the finest specimens of their kind that the company has found it possible to procure, and are certainly examples of most excellent work.

The annual report of the Bell's Asbestos Company, Limited, London, England, for the year 1905, is to hand. The result of the year's operations is a net profit of £18,575 15s. 2d. At the annual meeting the directors recommended the payment of a dividend of 12½% per annum, free of income tax, on the 30th of April. The affairs of the Company are in a flourishing condition. Additions to the buildings and plant at the Greenwich factory have been completed, and the sale of the company's estates in Canada effected, the company's requirements of raw material having been amply protected.

The Westinghouse Machine Company has begun a third suit against the Allis-Chalmers Company, in which infringement of another Westinghouse-Parsons steam turbine patent is alleged. The bill was filed in the Circuit Court for the District of New Jersey, and the Westinghouse Company charges the Allis-Chalmers Company with infringement of patent No. 788,830 owned by the Westinghouse Machine Company.

This patent covers the construction of the rotating element of the turbine as used by the Westinghouse Machine Company and the Allis-Chalmers Company. The suit was filed on Wednesday, April 11th.

The Westinghouse Machine Company, of East Pittsburg, Pa., has recently contracted with the Olean Street Railway Company to install in their power house at Ceres, N.Y., two gas engines for supplying current to the Olean Street Railway, serving Olean, Ceres, Boliva, etc. In the near future, power will also be supplied to an interurban railway system between Olean and Salamanca, N.Y., a distance of 15 miles. They will operate on natural gas having a calorific value of approximately 1000 B.T.U., which fuel is very plentiful in this territory. At present the Olean Street Railway Company has a steam power plant in service, burning gas under boilers, and a large saving is expected in using gas power.

The Canadian Westinghouse Company, Ltd., has secured several important contracts recently, among which are:—

One for supplying the Provincial Light, Heat & Power Company with apparatus to be used in the development of another large water power plant near Montreal. The initial installation will consist of three 3750 K.W., revolving field, alternating current, water wheel driven generators of 4,000 volts, three phase, 7,200 alternations; also twelve 2,500 K.W., 44,000 volts, oil insulated, water cooled transformers. This new power station will be used for supplying additional power to the Montreal Light, Heat & Power Company at Montreal. The step-up transformers will be wound for 4,000 to 44,000 volts, and the lowering from 40,000 to 12,500 volts. The transmission line is about 40 miles in length.

The Washington Portland Cement Company's new plant, located in Skagit County, Washington, on the Skagit branch of the Great Northern Railway, between Anacortes and Rockport about 104 miles northwest of Seattle, which was begun early last spring, is expected to be ready for operation by the end of April. The equipment, both for power and cement making, is, in many respects, worthy of note, being furnished by a single concern, the Allis-Chalmers Company of Milwaukee, whose hydraulic turbine will furnish power to a generator, which in turn will supply current for a full equipment of motors, mounted directly on the various machines used in the modern process of Portland Cement manufacture. It is the intention of the building company to bring the capacity of the plant up to the capacity of 3,000 bbls. per day by adding two kilns at a time.

One for the Northern Electric & Mfg. Company, of Montreal, for a second 300 K.W., Westinghouse-Parsons turbo-generator unit, to be installed alongside of one of the same capacity now in service. The generator is a 220 volt, three phase, 7,200 alternation machine, operating at 3,600 r.p.m. while the turbine will operate at 150 pounds steam pressure with 100 degrees superheat. Also, The Yukon Consolidated Company, Ltd., have placed a contract for the following: Three 100 H.P. 3-phase, 60 cycle, 400 volt, type F motors; three 15 H.P., 3-phase, 60 cycle, 400 volt, type F motors; three 50 H.P. 850 r.p.m., 3-phase, 60 cycles, 400 volt, constant speed induction motors; three 30 H.P. motors; three 20 H.P., 1,120 r.p.m. motors; three 15 H.P. 850 r.p.m. motors; three 7½ H.P., 1,700 r.p.m. motors; nine 75 K.W., oil insulated, self cooling transformers; two 625 K.W., 3-phase, 60 cycle, 2,000 volts, 415 r.p.m., A.C. generators, and two 17 K.W., type S exciters for same; one 4 panel switchboard for controlling the above; four 250 K.W., oil insulated, oil cooled transformers and four 200 K.W. transformers, same type.

COBALT NEWS.

Two more compressor plants are being installed at Cobalt—at the Drummond and Jacobs properties at Kerr Lake.

Machinery is being installed by the Cobalt Silver Queen Co., at the Stormont mine, and the Company expects to have its first car load of ore on the market by May 15.

The Toronto Cobalt Mining Co. is developing its property on Sasaginaga Lake adjoining the Tretheway mine. The Buffalo and Hudson Bay mines are on adjacent properties.

The Cobalt Hotel Company (Limited) has been incorporated, to carry on an hotel business at Cobalt. It has a capital of $30,000.

The report of a find of Cobalt ore at Montreal River has been confirmed. The property has been purchased by Mr. C. L. Hanson. It is situated 1½ miles from Latchford station on the T. & N. O. Railway.

It is reported at the Bureau of Mines that a vein of Asbestos, ten feet wide, has been discovered in the township of Coleman near the boundary of Bucke, but the quality has not yet been determined.

The second edition of part II of the Ontario Bureau of Mines, Report, dealing with Cobalt wire, contains a description of the Cobalt ores of Saxony and a copy of a French Map of Canada published in 1744, showing a part of the Temiskaming district.

The Wright silver-lead mine, six miles from Haileybury, on the east side of Lake Temiskaming, is reported to have been sold to McMartin Bros., of the La Rose mine, for $50,000. Fifty men will be employed. This is one of the oldest silver mines in Canada. It has a 38 foot ledge.

The Glendinning or University mine at Cobalt, owned by three students of the School of Practical Science at Toronto, which made its first shipment of ore in November, has produced up to date about $100,000. It is now well equipped for economical work.

Professor W. G. Miller, provincial geologist, left Toronto with a party, the first week in May, to make a thorough examination and topographical survey of the Gillies limits, which the government has announced its intention of holding and working for the benefit of the province. Prof. Miller expects to be engaged on the work a good part of the summer.

Another sale of mining property reported from Cobalt is that of the Nova Scotia mine to a syndicate composed of Messrs. Jas. A. Ogilvie and J. A. Jacobs, of Montreal, A. F. Maclaren, M.P., of Stratford, Corrie, of Toronto, Clarkson, of Hamilton and Steindler, of New York, the consideration being in the neighbourhood of $400,000.

It is not true that applications to drain two of the lakes in the Cobalt district have been granted. Applicants cannot secure claims under the lake until they have made a discovery of mineral *in situ*, which would be a difficult thing to do. Some parties did attempt to make tests with the diamond drill when the lakes were frozen, but they were prohibited.

A town has been laid out by a Toronto and Winnipeg syndicate, at Argentite, about two miles north of Cobalt. The town site extends from the T. & N.O. Railway to Lake Timiskaming, a distance of two miles, and it has been subdivided into about 4,000 town lots, which will be offered for sale at auction in Cobalt and Toronto. The land is fairly level. The town has been named North Cobalt.

Discoveries of gold bearing quartz have been made in the township of Playfair, about 70 miles north of Cobalt, by Charles Hurd, a surveyor. There are many rock exposures in the township, and many quartz veins. Cobalt bloom has also been found in the north western part of the township. Silver is reported to have been found at Iroquois Falls, 80 miles north of Cobalt.

Leading mine operators at Cobalt have decided not to employ union men, and an attempt to organize a miner's union has failed. A Montana miner, in the employ of the Nipissing Mining Co., who was the prime mover, was discharged. A scale of pay has been agreed upon by the mine owners, as follows: —Miners, machine men and hammer men, $2.25; underground laborers, $1.75; surface laborers, $1.25, with board in all cases.

A discovery of gold on the Montreal river has lately been announced. The locality of the find is some 70 miles above Latchford. The finder is a Port Arthur man named Quebel, who has been in the district since January last. The gold, it is said, is in quartz, and the vein about 4 feet wide. On the announcement of the discovery some 50 men left Cobalt for the new field.

The Mining exchange recently operated at Cobalt has been incorporated and will work under a provincial charter. Its official name is The Cobalt Open Call Mining Exchange, Limited. It has a capital of $40,000 and its provisional directors are Horatio C. Barber, Wm. A. Marsh and R. H. C. Browne, all of Cobalt. The first 25 seats were sold at $50 and the next 25 fixed at $100. Evening meetings will be held.

Dr. Robert Bell, Chief Geologist of the Geological Survey, has recently made a brief inspection of the Cobalt district, and reports indications of cobalt nearly 50 miles northwest of the present area. These indications appear to be based on the discovery by Mr. W. J. Wilson, of the Geological Survey during the last season's field work of some loose rock specimens between Sturgeon river and Lady Evelyn river. The country in which the specimens were discovered is a heavily timbered one.

The Columbus mine, near Giroux Lake, township of Coleman, has been sold to the Columbus Cobalt Silver Co., of which Hon. R. Harcourt is president, and Jas. Tudhope, M.P.P., John Flett, Daniel Simpson and Joseph Columbus, directors, the vendor, M. Columbus, taking his pay in stock. The mine is capitalized at $450,000. A force of men has been put to work. The mine was staked by Joseph Columbus, who has been prospecting in the district for 20 years, and whose perseverance has at last been rewarded.

The first general meeting of the North American Cobalt Refining Company was held at Toronto, April 25. The following board was elected: John Mc Martin, president; W. G. Tretheway, Vice-president; D. A. Dunlop, Secretary-treasurer; Milton, L. Hersey, R. W. Leonard, J. A. Jacobs, John Blair, E. R. Clarkson and Clarence Foster, directors. Practically all the prominenet mine owners of the Cobalt district have taken stock, and machinery is being installed in the works at Hamilton, where cheap power, cheap fuel and low freights can be secured. The works are expected to be in operation very shortly. It is believed that the refiners will pay for 95% of the silver values and make an allowance for the cobalt and nickel.

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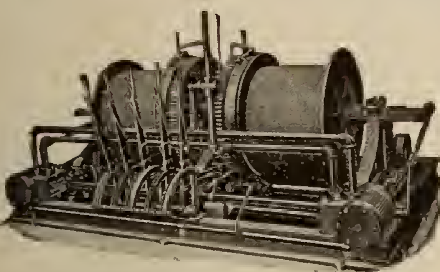

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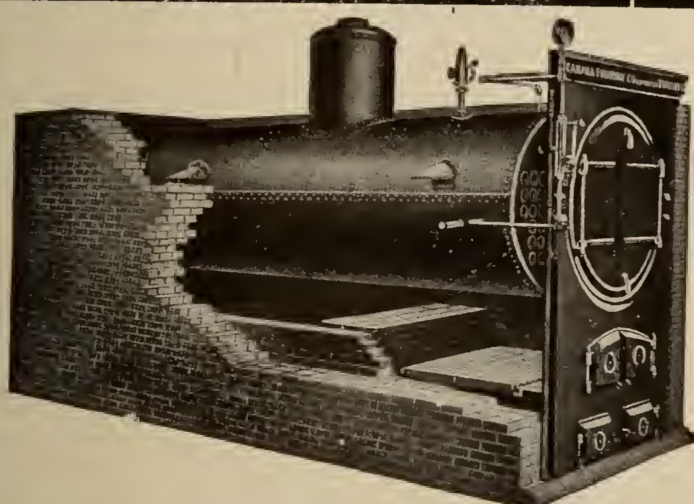

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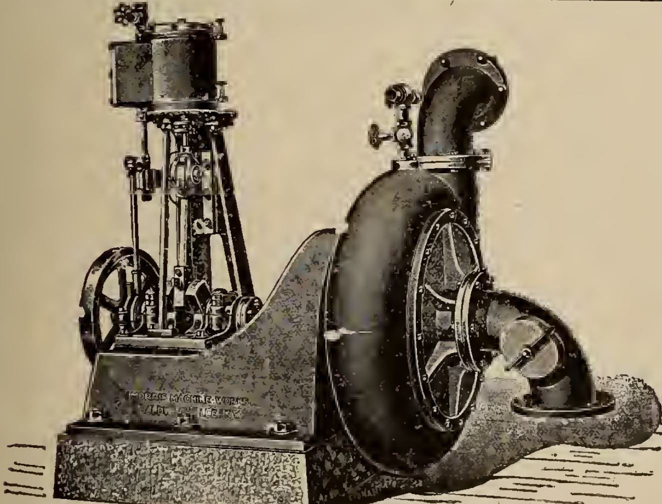

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SIGNS OF THE TIMES.

Now that there are signs of a renewed interest in mining, the daily papers are beginning to devote a considerable amount of space to mining affairs. They are making rather bad weather, however, of certain mining terms. For instance, quartz is spelled "quarts" in one enterprising sheet; it is also described as "acer-iferous." Nuggets of pure gold, as big as office ink-stands, are said to have been brought down from regions "away up North." La Tuque is spelled "Laterque." Chibogamoo has now become "Chi-bugamoo." But after all, the public is very much interested in these reports, and that is the object for which they are written.

A LITTLE KNOWLEDGE.

Ever since the days of '49, each succeeding rush to a new mineral district has been composed principally of amateur prospectors, men whom, while they were full of enthusiasm, knew next to nothing of mining or minerals. The Klondike had more than its share of these gentlemen. Although they were equipped with high boots, picks, shovels, drills and geologists hammers, they were usually utterly incapable of sinking to bed rock through three feet of gravel. Just at the present moment Cobalt is full of men of the same type, and their chance of finding anything of value is certainly not as good as was that of their predecessors in the far Northwest, because it takes considerably more knowledge of formations and minerals to seek intelligently in Ontario and Quebec than it did to discover placer gold in the Klondike.

But the optimism of some of these amateurs is a beautiful thing. The geologist goes to his task with a thorough realization of its difficulty; they can see no trouble ahead, but depend upon inspiration for the discovery of mines that will sell for at least a million dollars a pace. Happily, our Northern hinterland is peculiarly favourable to health and longevity, so that it is not probable that a season's roaming will hurt these young fellows, on the contrary, it will do much to increase their vitality, and fit them for a long, useful career of office work when they return. But we will venture to predict that the only men who will achieve much in the North will be those who are accustomed to life in the open, are imbued with more than average physical strength, and are expert not only with the pick, but with the paddle.

PERSPECTIVE IN MINING.

By J. Parke Channing.

(Address delivered before the Engineering Society of Columbia University).

The melancholy Jacques in "As You Like It" says, "Call me not fool till Heaven hath sent me fortune." Call me not fool till Fortune hath sent me the opening up and equipment of a mine; for in mining there is so much that is not teachable, nevertheless learnable, that unless a man has this instinct, inherent in all capable persons, he can never hope to achieve success as an engineer. Each mine is, so to speak, a law unto itself, and not until the engineer recognizes this can he get true perspective in mining.

When you leave school and start out in practical life there are certain things that you have heard in your studies which have impressed themselves upon you. The reason for that impression would be hard for you to say. It may be that some particular thing had interested you because of some previous experience of yours. As a result you are really not able to define the proper relations between things, and that is one of the reasons why a man, after he graduates, should not start immediately on consulting work, or to take entire charge of any enterprise.

It should be remembered that your course in the school is simply one of preparation; in other words, if you want to learn the mining business you have got to go into the mines and study it, just as if you were going to learn the dry-goods business you would have to go to a dry-goods store; to learn banking you would begin as a messenger or clerk and work your way up. The only advantage of going to a school of mines is that you get a technical education; you have a certain ground-work, which helps you out, and you also have gained a very important thing in knowing how to study, and knowing how to put two and two together so as to make four, and not three or five.

When a man goes out I would advise him to get a position at some mine or metallurgical works; it is not always desirable that it should be a particularly large mine or works; often he gets a better knowledge of what is going on by working in a smaller mine. When you take your first position in a mine I would advise you to work underground. This gives you an opportunity of watching mining work—sinking, drifting, stoping, timbering, tramming,—and it particularly gives you your first idea of the proper relation of things.

About fifteen years ago I was running the East New York mine at Ishpeming, Mich., and Mr. T. F. Cole, who is now manager of all the iron mines of the United States Steel Corporation, was running the Queen group of mines at Negaunee, Mich. We used to compare cost sheets, and his cost of development amounted to 2 5 cents per ton and mine amounted to 25 cents per ton. The reason for this was that his ore-body was in area ten times as large as mine, and, although my shafts and crosscuts were of the same length as his, the decreased tonnage was against me. This simply shows how the cost of development has got to be watched in its reference to the size of the ore deposit.

Take for example the opening of an iron mine at Lake Superior; after first striking the ore, the proper thing to do is to sink a small one-compartment shaft, one big enough for a good size bucket and ladder. With a shaft of this size you can get down to the ore and you can get out a good deal of ore. After you have gone down a hundred feet and have your drift, and have some idea of the size and shape of the ore-body, you can, if you find the conditions warrant it, put in a larger shaft.

I have seen prospecting or development schemes wrecked by the man in charge spending a lot of money and time in sinking what he called a "working shaft," and when he got down found that there was nothing to work, or at least it could have been worked through a small shaft. In prospecting or small mine work you don't want to put in any brick set or water-tube boilers, and you don't want too large an engine. You want to get a cheap portable locomotive or upright boiler. It won't hurt to burn a few extra cords of wood.

On the other hand, you also want to try to get the idea of how far you should go on equipment without going to the point of over-equipment. Suppose, for example, that you finally take hold of a mine that is developed and is producing ore for shipment, and you find the mine is fairly well equipped when you get there. You may find a great many things that do not satisfy you or do not come up to your ideas. You may find a shaft-house that was badly arranged; you may find that the hoisting engine is one that uses too much steam, and the compressor is not the right thing; that the shaft is crooked, and there is no skip, only a bucket. Now, don't be in too much of a hurry to tear all of these out; go ahead and see what you can do with them, until you get to the point that you can definitely see and figure it out in dollars and cents, just how much you will save if you were to sink a new shaft or straighten out the old one; or if you were to build a new engine house or put in a new engine.

Some of the men who were at Copperhill, Tenn., last summer remember the excellent plant we had at the Burra Burra mine; there was a brick house containing water-tube boilers; there was a big power-house which contained a first-motion hoisting engine, together with a cross-compound, two-stage, air compressor, with room to put in another one. There was also a shaft crusher house with its paraphernalia. When I equipped that mine I had at the same time the idea of later putting in a similar equipment at the London mine, and I had the plans drawn and everything arranged for it. But, after carefully thinking the matter over and seeing the tonnage that came from the latter mine, I finally came to the conclusion that I would make a great mistake to take this mine, which was only 500 ft. long and 30 ft. wide, as compared with the Burra Burra, which was 1,600 ft. long and 80 ft. wide, and give it the same equipment, notwithstanding the fact that it would be very nice to have two or three mines all provided with exactly the same type of equipment. So, instead of putting in a duplicate of the plant we had at the Burra Burra, I simply bought a cheap geared hoist and put it back of the London shaft in a small building covered with corrugated iron, and we used the same boilers that had been used there since the beginning of the development work.

The more you work the more you will find out that there is absolutely nothing that cuts down cost as much as tonnage. Another suggestion is this: When you start up a new mine don't be in too much of a hurry to build a nice house for the manager or superintendent, or too grand an office building. That is one of the things that an English engineer at a new mine looks after before anything else. The first thing he does is to build himself a house, and then he goes ahead and develops the mine. If your mine happens to turn out all right it is very good to have lived well while developing it; but if it does not turn out all right, then the house that you built will be a monument to your folly. While I don't advise you to open up a mine and live in a hut or tent all winter, you must use proper judgment as to the kind of a house you do build.

Take, for example, the cost of underground haulage; you know that the tendency now a days is to do underground haulage, wherever possible, with electric locomotives. It figures out as very economical, and the electrical people will be only too glad to estimate on the cost of installation and operation, but you must remember that it is the opinion of most mining men that for medium distances, say 500 or 600 ft., you can do nothing better than to use man power, for the reason that you have to give the man loading the cars a rest and he gets this rest, if the grades are properly made, by pushing his car out and waiting a minute or two at the shaft until it is dumped, and then pushing the car back again. This is a change from loading the ore, and so he trams really for nothing.

At one of the mines in Bingham Canyon, Utah, they mine about 1,000 tons per day, and it comes out from one adit, where it is handled by four horses—two on each shift. At one of the adjoining mines they put in an electric tramming plant, and yet the tonnage they have could readily be handled by two horses. It does not take much figuring to see that two horses are cheaper in first cost and up-keep than an electric installation. So, therefore, in adopting any particular apparatus, or any particular method, you must take into consideration the tonnage and conditions under which it is operated.

When you come to metallurgical work this factor will be strongly emphasized. Remember that you do not want to get things too automatic. I remember when I was talking with the late Richard P. Rothwell, of *The Engineering & Mining Journal*, about Mr. Edison's iron-ore plant out in New Jersey; he said that the plant was too automatic, and that once in a while there should have been an Italian with a shovel. You will notice that at some concentrating mills they may have a certain product that has to be handled or moved to some other part of the plant for re-tretment. In a small mill that amount is so slight that one man could shovel it as it accumulates, so that under these circumstances it is no use putting in an elevator or some other apparatus to handle this small amount of material. In a large mill, however, it may be really necessary to have something to carry your concentrate and middling from various points where they are produced to a central point.

In metallurgical work, modern practice is along the line of labor-saving devices, but in a small blast-furnace plant, where you have but one furnace, it is a question whether it would pay you to put in a so-called automatic charging apparatus. This is the method in use at large plants, where the ore is run into cars and pulled by an electric locomotive to the furnaces. I believe that there is no doubt that one could get better metallurgical results in copper-blast furnaces by hand-charging than by dumping the charge from cars, but the cost would over-balance the metallurgical saving.

In places like Mexico, where wages are only 75 cents to one dollar per day, it is sometimes impossible to get enough men to do the work, which, of course, necessitates your putting in labor-saving devices, not to save money, but to run at all. When we started in Tennessee labor was a dollar per day, and we seriously considered whether it would be advisable to put in a charging apparatus for the furnaces. But I felt that in the South it would be difficult at times to get labor, and so, fortunately, I put in electric charging cars, and they have been a great success. This question of shortage of labor is important in an agricultural country. Take for example in Mexico: In the spring-time the men go off to plant their corn, and when it comes autumn they go off to harvest it. You notice the same thing in Tennessee. In the spring the men go to plant their crops, and when the time comes to harvest, off they go; they do this regardless of whether it would pay them better to attend to their farms or not. For instance, in Central Mexico, where laborers receive two or three dollars a day, a man will leave his position and go to harvest a $30 crop and lose $60 in wages.

A man can frequently be penny wise and pound foolish in refusing to advance the wages of good men. So do not always be looking at your pay-roll with the idea that the best way to economize is to cut down wages. The first thing that an untrained man does when he goes to a mine is to try to find some way to save money. He looks at the pay-roll and finds that it amounts to $10,000 per month and that the supplies are $5,000, and that the mine is running behind. He concludes that the only way to remedy the matter is to cut wages. He does this; his men loaf, or the best leave him, and he runs still worse behind.

You want to be careful to see what work per man per day you get, so therefore it is essential to remember when you are engaging labor to pay about the same wages that are being paid by others in the district, and be slow about reducing wages, but see that the men work. Try rather to keep your wages a little bit higher than anybody else, so that you can get the best men; let the other fellows keep the poor men. If you get a good man and pay him 25 cents more per day, he will probably do a great deal more work.

Perhaps the young men who were down in Tennessee remember the two big trammers we had at the Burra Burra mine. One of the men has been with us at least four years. He is a stout, husky fellow, and would load just as many cars as two ordinary men would do. The ordinary man would load ore at 18 cents per car and perhaps get out 20 cars per day, while this one man would get out 16 or 18 cars himself. Now, then, think of the money we would save if all our men were of that kind. It would mean that, if we wished to, we could practically double the output of our mines.

Another thing you want to bear in mind is this: Never be afraid to engage a man who knows more than you do; that is just the kind of a man you are looking for and just the one you want. A young man, as a rule, never wants to engage a man, or have any man under him, who knows more than he does. If you engage a foreman, get one that knows all about the handling of men. If you get an engineer, get an engineer, that knows something that you do not know, one who has had lots of experience at other mines; his experience will be of great benefit to you in solving new problems that will arise.

While I have referred more to the economical details of operating, there is another perspective view which takes a long time to get, and that is a comparative idea as to value of mines—whether there is really a mine or not—or whether it is going to be a small mine or a large mine; and the only way you get that is by looking at as many different mines as you possibly can. Never loose a chance when you are travelling or looking for a job to go into a mine and through its workings. If you visit a mine of any importance, try to get a position in the underground workings, because that is one of the things they cannot teach a man and which can only be acquired by long experience and by looking at different properties.

I might say that your college experience has enabled you to make a quick decision. Really the main thing in mining is the capacity to see a property in a partially developed stage and from that inspection be able to determine whether it is going to be a mine. You find that it has 50,000 or 60,000 tons of ore in sight, and that it seems to have the earmarks of a large deposit, and you will advise your people to take it. If you have the courage of your convictions, if you think that it is good, stick to it and do not let the property go by. It is a great deal better for a man to make a mistake once in a while in getting hold of a property that does not turn out well than it is to let a good one go by. Still, however, if a young man makes two or three of these mistakes, it is likely to go against him in the long run; so I say to you. that when you start out, keep away from making these examinations, or, at least, from consulting work. It is very nice for you to go in as assistant to some engineer and help him in sampling and making determinations as to the value of mines, but do not get yourself into a position where you are called upon to pass judgment upon mines, because you may get yourself into some bad predicament, which will take a long time to live down.

I do not want you to understand that I would recommend a man starting out to begin as an assistant for an examining engineer. It is pleasant work, but I think that if one starts out in it he is liable to get rather a bad habit. Remember that the really successful consulting engineer is that man who has the capacity to size up a mine and to determine its value, and who thoroughly understands the cost of operating it. The whole tendency to-day is toward the mining of low-grade ore bodies, and the question of operating expense is one of vastly more importance than the question of sampling and assaying the ore. For example, take the large porphyry ore body in Bingham Canyon, Utah; a man who examined it stated that it averaged less than 2%, yet his samples checked those of the mine manager within 0.01 per cent.

I recently examined a concentrating property in Nevada and the ore ran slightly under 3%, my samples checked on one of the mines within 0.03% and on the other mine within 0.02% of the results of the management. So you see that sampling, to a certain extent, is mechanical. In a large concentrating proposition of this kind the main thing is, what is it going to cost to mine and treat the ore. The original report on this mine by the manager had been taken over to Paris by the senior member of a large banking house and the figures as to the grade of the ore and the cost of treatment submitted to several French engineers, who simply laughed at the thing, and said it was impossible to treat ore of that grade. My examination showed that the conditions were exactly right for a big property —one that could be handled and show a large profit. The trouble with the French engineers was that they had not kept up with the latest practice in concentrating or the latest methods in reverberatory smelting, and, while they were only two or three years behind, they might just as well have been twenty years behind the times. Therefore, I say to you that one of the most important things for a successful consulting engineer to have is a good knowledge of operating; the only way to get a true idea of operating is to work your way up from the bottom.

There is also one other important thing in mine examination and mine operation, and that you have to study and pay particular attention to, and that is the geology. If it is copper, you must keep yourself posted thoroughly on secondary enrichment; if you do not, you will have difficulty in getting along. It was about eight years ago that I examined the Highland Boy mine in Utah; the fourth and fifth levels were then opened up and showed an average of about 7.3% copper and considerable gold and silver, but I could see plainly that a good deal of that copper was in the form of chalcocite, which I knew was secondary. Another engineer, who came out about the same time, looked the property over, and, although he agreed with my sampling and assaying, he predicted that the sixth level would only go one per cent; he gave too great a weight to secondary enrichment; later developments showed that the lower levels went four per cent. and the result was that his people lost a fine property. This simply shows the necessity for keeping thoroughly up on the literature of ore deposits, because it is being added to day after day with great rapidity. Of course, this is not as absolutely essential to you as a knowledge of operating, because there are certain geologists who make a specialty of studying ore deposits. In case of necessity, you can get a man of this kind to help you out, and you perhaps may be able to make certain economic conclusions which he was not able to see. Some of the big mining companies keep an economic geologist at work all the time. In a small mining company that is impossible, and the geologic work devolves upon the mining engineer.

When you get a mining engineer you want to get a man that has been well schooled, one who understands geological conditions and is able to lay out future work. This has been done in the Butte mines in the last three or four years, and I believed there is not a single crosscut in the mines of the Amalgamated that is not laid out on paper in the office before a stroke of work is done underground. Of course, you get a much better training now in geology than I ever got, not because your professors are any better, but simply because the subject is more thoroughly understood than it was twenty years ago.

Therefore, I say to you study economic geology just as much as possible, because the question of ore deposition is one of such vital importance that you must forever have it before you. Whenever you see an ore body, and it is a particularly rich one, you want to look at it carefully and study the conditions and try to determine whether these conditions exist a hundred or a thousand feet down, or whether they are only local conditions. This capacity to see is one of the things that you can only learn by going around and seeing, and remembering what you see.

SOME LABORATORY EXPERIMENTS WITH ELECTRIC FURNACE.

By J. W. Evans.

The following experiments were begun in April, 1904, but, as the writer had only his spare moments to devote to the work, it was not until September, 1905, that satisfactory results were obtained.

In the first experiment a fire clay furnace was used with electric energy supplied by a small Brush direct current generator of 20 amperes at 35 volts, driven by a 2½ H.P. gasoline engine.

The results were not satisfactory, the voltage being too low to keep the arc alight, and it continually went out causing annoying delays, also the amount of ore treated at a charge was very small, and, although some small steel buttons were obtained, it was decided to work on a somewhat larger scale. Not being able to purchase a larger generator, the writer built the alternating current generator and exciter shown in

PLATE I.

PLATE II.

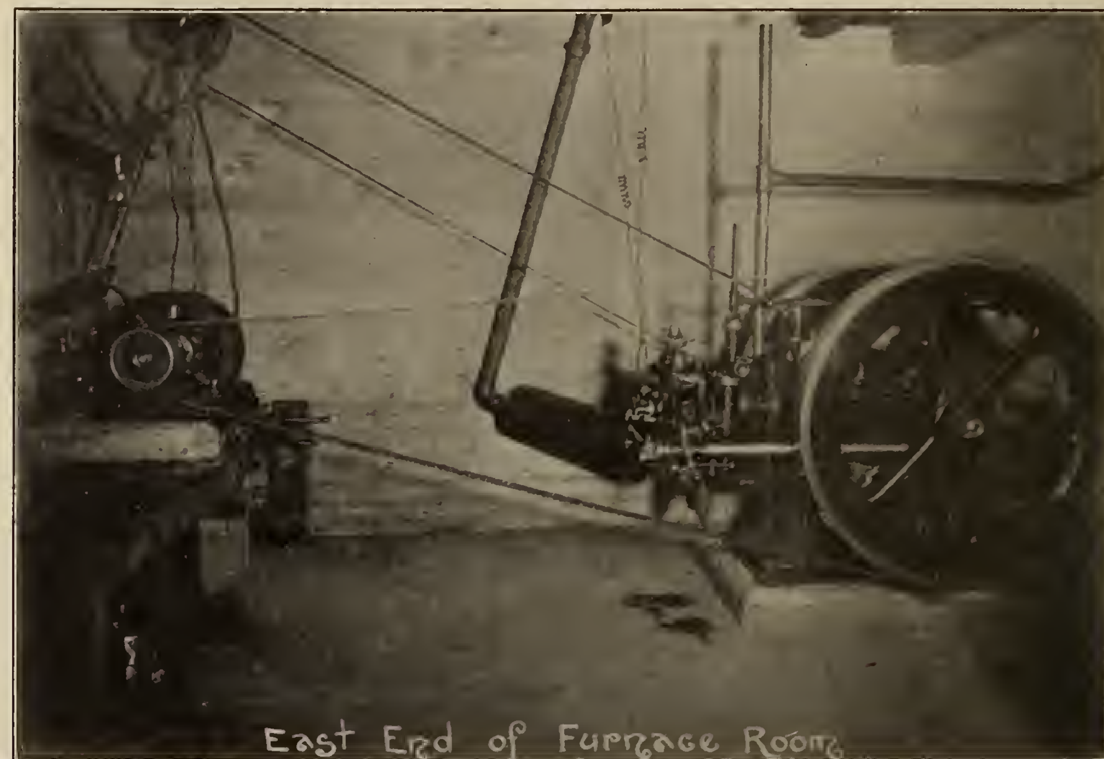

PLATE III.

PLATE IV.

photograph No. 3, during the winter of 1904-5. Plates No. 1 and 2 show the workshop. This occupied his spare time that winter, and it was not until June, 1905 that smelting operations were begun again. The generator was built to furnish 30 amperes at 50 volts, and gives from 40 to 50 amperes at 50 volts for short runs without undue heating, and is driven by a 4 H.P. gasoline engine, furnishing energy for the three furnaces shown in Diagrams No. 1, 2 and 3.

DESCRIPTION OF FURNACES.

Diagram No. 1, is a furnace of the reflected arc type as devised by Moissan.

In Diagram No. 2, the electrodes are placed in a vertical position, the lower electrode passing through the furnace to the carbon crucible, which rests upon carbon packed round the electrode. The lining of the furnace consists of corundum mixed with 8% of tar and is baked for 48 hours in a hot oven before use.

The carbon crucibles are made of ground carbon and tar stamped out in a large sized cupel mould and baked in the same manner.

The furnace is supported by an iron ring stand such as is used in laboratory work.

Diagram No. 3 shows a furnace arranged for either fire clay, magnesia or carbon crucibles, and has the electrodes suspended above the furnace, they can be raised or lowered at will, and the arc gap can be regulated. The holder for the electrodes is made of hardwood (See Fig. 4, Diagram No. 3), with two ¾″ holes bored as shown. A "V" shaped cut between the electrodes, and extending almost through the wood, allows the holder being bent as shown by the dotted line. An adjusting screw regulates the amount of bend, and two handles projecting out behind enable the electrodes to be put in contact to start the arc, when, upon releasing them, they spring apart to the distance set by the adjusting screw. This makes a cheap and efficient holder. The carbons should fit the holes snugly; if loose, a screw at "f" holds them securely. As the iron ore, when fused, has a tendency to draw down the arc, the arc plays round the crucible at the extreme ends of the electrodes, and in both this furnace and in No. 1, the writer has made a mild steel from the ore in 20 to 25 minutes taking an ounce of ore at a charge. By adding more ore from time to time, a continuous furnace can be made of each of the above furnaces until the capacity of the crucible is reached; the large buttons shown were obtained in this manner. When using a carbon crucible a coarse-grained pig iron is first obtained, by leaving this in the furnace too long it takes up considerable carbon and puffs up into an iron carbide. No. 2 Furnace having the current passing through the charge, and requiring a carbon crucible, is not as quiet a running furnace, and the product is not a fine steel but a coarse-grained pig iron; buttons of steel were obtained from this furnace, but it does not work as well as the suspended or reflected arc furnaces. The writer is now using a special design of furnace which completely reduces an ounce of ore in from 15 to 20 minutes, and converts it into a fine steel.

FURNACE LININGS.

For furnace linings the following substances were tried, fire clay, magnesite, carborundum and corundum. Carborundum or corundum mixed with 8% of tar, when thoroughly baked, makes a very satisfactory lining, although it must not come in contact with the iron charge. An inside lining of magnesite overcomes this difficulty. At present the writer is using fire clay crucibles in a furnace lined with corundum and tar, the crucibles being broken after each operation. Pouring the slag and steel was tried, but it was found that such small quantities cooled too quickly for pouring.

REDUCING AGENT.

As Charcoal is the only available domestic reducing agent obtainable in North Hastings and other parts of Eastern Ontario, the experiments were confined to its use as a reducing agent.

ORES HIGH IN SULPHUR AND TITANIUM.

In treating the sulphurous iron ores over 92% of the sulphur was slagged off, and by varying the amount of lime, better results should be obtained. In treating the titanium iron ores, steel was produced which did not contain a trace of titanium, but, as the writer wished to retain a portion of the titanium, the quantity of lime in the charge was reduced and the result showed that the titanium contents in the steel can be readily governed in this way, although the temperature of the furnace will have to be kept as constant as possible.

When one considers that there are immense bodies of titaniferous and sulphurous iron ores in Ontario and Quebec, and that fine water powers are within reach of many of these deposits; that there is abundance of wood for charcoal and quantities of limestone for flux in the immediate vicinity of the ores; that in treating them by this method one does away with all preliminary treatment, such as magnetic separation, roasting, etc., and obtains steel in one single operation. It does appear that the day is not far distant when Ontario and Quebec will be able to do their share in furnishing fine grades of machine, spring and tool steel, not to mention the possible valuable by-products, such as titanium-silicon, etc., obtainable from the titanium slag, etc.

In the writer's opinion it is doubtful if Pig Iron can be made in Canada by the electric furnace cheaply enough to compete with the blast furnace at the present time, but the finer grades of steel undoubtedly can be made profitably when smelted directly from the ores.

IRON SANDS.

This process should also solve the question of treatment of magnetic iron sands, of which there are large deposits in both Ontario and Quebec, and the writer has made a mild steel containing .05% carbon from magnetic sands from the St. Lawrence River. These sands could be dredged and dried, magnetically separated, and conveyed direct to the furnace at a considerable saving in cost over mining and crushing iron ore.

ANALYSES OF ORES AND STEEL.

The following analyses of the ores, and of steel obtained from them may be of interest:

ANALYSES OF ORES FOR IRON, TITANIUM AND SULPHUR.

Coe Hill Ore (*Sulphurous*).		Bowen Mine Ore (*Titaniferous*).	
Iron	68.01%	Iron	45.17%
Sulphur	1.01%	Titanium	7.44%

A.

ANALYSES OF STEEL FROM COE HILL ORE.

No. 1.	No. 2.	No. 3.
Silicon 01%	Silicon.. . . .a trace	Silicon 04%
Sulphur 12%	Sulphur. 17%	Sulphur. 08%
Carbon 05%	Carbon 07%	Carbon 06%

B.

ANALYSES OF STEEL FROM BOWEN MINE ORE.

No. 1.	No. 2.	No. 3.
Silicon 62%	Silicon. 2.31%	Silicon. 05%
Titanium 37%	Titanium . . .1.02%	Titanium . . . .none
Carbon. 51%	Carbon 84%	Carbon . . .0.87%

When much lime is used as flux, titanium slags off readily. If titanium is retained in the steel, by lowering the amount of lime a large portion of silicon is retained also

In B. No. 2, the proportion of ore to lime was ten of ore to one of lime. In No. 3, ten of ore to two of lime.

Plates 5 and 6 show the writer's laboratory where most of the determinations were made, but the writer's thanks are due to Mr. A. G. Burrows, of the Provincial Assay Office, Belleville, who made several of the determinations. A number of samples of the ores, steels and slags are shown in the case on view, duly marked with the analyses, and locality, etc.

ANOTHER SMELTER FOR COBALT ORES.

Mr. Emil R. von der Osten, C.E., the future superintendent of the German-Canadian Smelting and Refining Company is now in Toronto. It is proposed to erect works on a site somewhere on the line of the Temiskaming and Northern Railway; the Provincial Government granting a free site. Mr. von der Osten has furnished the CANADIAN MINING REVIEW with the following details of the proposed undertaking:—

The German process may be used in Canada on certain conditions, the most important being that the process is kept secret.

Final arrangements must be approved by the First Director of the Geological Institute & Mining Academy, Berlin, Herr Geheimrath Schmeisser.

The experts must be Germans.

The works will be concentrating, roasting, refining and Cobalt-blue Works.

The German National Bank would like to see the works in Germany if this were possible, and might then finance the whole; if they are established in Canada, the bank will assume a part of the financing.

In Germany 52% of the world's production of cobalt oxide is used, and Mr. von der Osten has guarantees for a market of 100,000 lbs. Ore was sent in November, 1905, by the Commissioner General of the Canadian Government at the Liege Exhibition to Germany for treatment, and the results were very satisfactory. The experiments were made by Prof. Pufahl and Dr. Krusch.

The intention of the company is to put up a concentrating plant first, to treat low grade ores, and then the cobalt oxide works; lastly a roasting plant. That means that the company's works will be started with the wet and dry process.

The expenditure in Canada will be about $445,000. The headquarters will be in Toronto, and the name of the company will be changed to The German-Canadian Smelting and Refining Company. The capital will be $1,000,000.

The Allis-Chalmers Co., Chicago, are supplying part of the machinery. The special machinery will come from Germany.

Mr. von der Osten is sailing for Germany in a few days to complete arrangements.

A FEW HINTS TO PROSPECTORS.

By CHARLES A. BRAMBLE.

Prospecting, up to and beyond the Height of Land, is a new pursuit, and men who have grown grey at the game in other regions will find that they have a good deal to learn when they take their fortunes in their hands, and embark on the waterways that are

PLATE V.

PLATE VI.

tributary to the Ottawa, the Moose, and other streams flowing north and south from the parting. Practically, the only routes by which a man can travel are the rivers. The pack pony and the burro are unknown; there is no grass, so that animals would have to be fed upon imported provender, and, this of course, would render the use of a pack train almost an impossibility in the case of prospectors. Happily, of waterways there is no end, and the canoe will carry a man and his belongings, provided they be few in number, to the uttermost parts of that great lone land that is so soon to resound to the hum of industry and the throb of machinery.

But that's the rub. In order to travel successfully in the North, the prospector should travel light. He must cast away all superfluities, and do without luxuries. He will find tinned food a mistake; strong men in hard work need the sustaining power that is given by good Chicago mess pork and the solid and substantial bean. Cans are heavy, and no one cares to carry useless weight over the long and arduous portages that bestrew the way of the wanderer, so liberally in the homeland of the Algonquin. During the summer a pair of blankets should suffice in the way of bedding; a light tent made of drill will, if properly pitched, keep out even heavy rain, and is therefore to be preferred to duck or canvas, each of which weighs more than the drill; for those who understand the "birchbark" it is to be preferred to the Peterboro, or any other wooden canoe, as it is a better craft in bad water, lighter, and considerably easier to portage in consequence of its depth, the shallow Peterboro, resting upon the head, while the deeper birchbark presses on the shoulders. But a birchbark would be of no possible use in the hands of a man who did not understand its peculiarities, being fragile as a bonnet-box.

Provisions must be simple, nutritious and easily prepared. Everything should be packed in cotton bags, otherwise some very interesting mixtures are likely to result, though it is a question whether they would be appreciated by a hungry prospector trying to prepare a toothsome meal at the end of a hard day's work.

The green hand is almost sure to visit some of the outfitting establishments, and be persuaded to buy fancy sleeping bags, pack baskets, safety axes, and other ridiculous impedimenta. A new flour sack, costing a quarter, makes an admirable dunnage pack. Coarse grey blankets are preferable to a sleeping bag for summer work, and in the winter nothing will equal a rabbit skin blanket, which is only to be had from the Indian. All packages should be made up in a blanket roll and carried by a broad strap, called a thromp line, which may be worn looped over the forehead or the shoulders. Those who are not accustomed to carrying heavy weights almost invariably use the line around their shoulders, but as this interferes with free, deep breathing, and, moreover, renders it almost impossible to throw off the pack in a hurry, it is not a practice to be commended. The only workmanlike way to carry a heavy pack is with the thromp line resting across the forehead, and the weight reposing in the hollow of the back; but it takes some practice to develop the muscles of the back of the neck until they can endure the strain.

Not a few prospectors have been drowned through having packs so rigged that they could not free themselves from them at will. If a man slips when walking a slippery log, or when crossing a wet tree trunk spanning a torrent, he is almost sure to come to unutterable grief if his pack is not so hung that he can free himself without the loss of an instant.

Perhaps the most difficult part of the outfit to arrange for is the prospecting tools. Drills and hammers are too heavy to carry over long portages, unless the party is quite a strong one, so that it is, probably, wiser for the solitary prospector, or for a small party, to be content with their axes and prospecting hammers. The blow-pipe, if the prospector has sufficient knowledge to use it intelligently, is invaluable. A dipping needle should not be omitted, and a thermometer, aneroid, tape line and prismatic compass are useful.

Although the main waterways are, as a rule, laid down on the latest maps with fair accuracy, there are great stretches between the larger rivers that have never been visited by surveyors. These are the most tempting fields for exploration. The possibilities are great, but in order to cover much ground in a short summer, the prospector must be equipped in such fashion as to be able to go from point to point with great rapidity. When matters can be so arranged that he will not have to make more than one trip over each portage, he may cover long distances day after day without effort and fatigue; when, on the other hand, he has to return several times, he will not be able to go far. The Indian generally manages to get along with an outfit that enables him to go straight ahead from morning until night. A solitary Indian trapper uses a birchbark canoe 9 to 11 feet long, weighing not over 25 lbs. His dunnage will not often weigh more than 75 pounds, even when it includes one or two steel traps and his rifle. Owing to his strength and endurance he can easily carry all his belongings, including the canoe, upon the head, so that each portage only occasions a comparatively short delay. Under these conditions thirty miles a day can be accomplished by a good man for several days in succession. On the other hand, parties of white men burdened with a heavy outfit may not average five miles a day on bad rivers.

Although, there is often game and fish to be had, it is not wise to trust too much to the resources of the country. It is wiser to always have a sufficient stock in reserve to carry one to some Hudson Bay post or Indian encampment, where food can be obtained. When fish or game is abundant the prospector should husband other provisions, only drawing upon these when necessity arises. It is a great mistake to think that vegetables and flour, sugar and tea are absolute necessities. Life, and not only life, but health may be preserved upon game or fish for an almost indefinite period, the only condition nature imposes being that the man thus fed take sufficient exercise, and this is rarely lacking when the settlements are left behind, and a man's own arms or legs furnish the motor power.

The special correspondent of the *Mail and Empire* wrote to his paper from Cobalt:—Until the coming into prominence of the Cobalt region, "prospector" was a term little known in Canada, at least in Ontario. Now, however, the name "prospector" is claimed by nearly nine out of ten of the people one meets up here in this North country.

From the picturesque shores of Lake Temagami to the breezy plateau of the Height of Land and beyond the prospector is blazing his trail. Having procured his license, for which he contributes to the Provincial Treasury a fee of $10, he gathers together his outfit which generally consists of the following articles: A light canvas tent, a sheet-iron folding stove, the indispensable pork and beans, with flour, meal, salt tea, coffee, and sugar. Portions of his ordinary attire are discarded for a sweater, long boots, and slouch hat. A canvas sack bound by a tote strap, is used for carrying supplies over his shoulder. A hand axe and six-shooter fastened to his belt, with a shining new prospector's pick in his right hand, complete his outfit. He then immediately proceeds to "hit the trail," and, with the recklessness of "Rasselas, who tired of his happy valley and sighed for the free breezes of the hill tops," he keeps moving along. He invariably selects for his camping place a locality where likely ledges of rock abound, and as convenient as possible to a good supply of water. The light stove he carries is more for the purpose of heating the tent at night, for his cooking is generally done outside on the old-fashioned camp fire. Often he is alone, but generally four or five band together, and one of their number acts as cook. The privations and hardships they undergo are innumerable and indescribable, but they are mostly forgotten in the feverish quest for wealth, for there is ever present before the mind's eye of the prospector the constant anticipation of "striking it rich."

The foregoing extract should be carefully studied by would-be prospectors with a view to avoiding such an outfit as is here mentioned. When the "Yukoner" made his famous rush for the golden North, the one article of equipment that he hugged more closely than any other was his little, foolish sheet iron stove. The hardy old sour doughs had never heard of such a thing. They had always found a good log fire in the open sufficient for their wants when they were travelling and if they were in a permanent camp, they manufactured most ingenious chimneys out of rocks and clay; but the Yukoner could not do without his sheet iron stove, which was simply a burden to him in most cases. It seems that history is repeating itself, and that in Northern Quebec the aforesaid stove is penetrating the places that knew it not.

Again, we are told that the latest variety of prospector is wearing long boots. For canoeing purposes the long boot is about the worst kind of boot a man can put on his foot. If he adds some good sharp nails to this heavy foot gear, he will achieve the wrecking of his canoe all the earlier. Ankle boots or moccasins are far better. Why any man should want a sixshooter in Northern Ontario surpasses our comprehension. It must indeed be a magnificent sight to see one of these brand new prospectors starting off with an axe in one hand, a shining prospector's pack in the other and a six shooter fastened to his belt. But we think that after a few month's initiation, if he should stick to the game, the elaborateness of his outfit will have much diminished. As to the privations and hardships that he will have to undergo—it is altogether probable that most of them will be brought about by his own ignorance. It is a hardship to pack hundreds of pounds of useless dunnage over bad portages; but why take the useless dunnage? Would it not be better to sit down calmly and consider each article of the outfit in succession, discarding everything that it would seem possible to do without? The proper question is not "would this be of use to me?" There is hardly anything that is used by civilized man that might not come in useful in certain contingencies. Better far to say "would it not be possible to do without this?" To make something already included in the outfit serve a double purpose. If the answer should be in the affirmative, cast the said article aside without compunction.

The great mineral-bearing formation is, of course, the Huronian, and it would be well if every prospector made as careful a study as he could of this system. The writings of Messrs. Adams, Bell, Low, Miller and others, should be studied. These geologists have placed the Huronian above the Keewatin and below the Keweenawan. All these are, of course, pre-Cambrian, and hence very ancient formations. The silver ores of Cobalt are found in veins that traverse the lower Huronian; and the rocks of this series, consisting as they do, of conglomerates, breccias, quartzites and greywacke slates, should be studied very attentively. But the mineral-bearing veins do not seem to have been enriched excepting within a definite distance of masses of diabase, gabbro and other intrusives. As the patches of Huronian vary in size from a few feet to hundreds of square miles, and are surrounded by unpromising Laurentian strata, it behooves the prospector to acquire at least a bowing acquaintance with them.

In conclusion, it may be said that while prospecting is a comparatively new occupation in Ontario and Quebec, it is full of promise, and one that will often repay those who enter upon its prosecution intelligently.

IRON ORES RESERVES.*

By CHARLES KENNETH LEITH, Professor of Geology, University of Wisconsin.

The great increase in the world's annual consumption of iron, together with the attempts of large interests to acquire the known iron ore reserves, have led to careful inventories of the world's supply of iron ore, its rate of depletion, and to speculations as to further supplies. Estimates of the time of exhaustion of the present known supply have varied widely, but have shown startling agreement in the short time assigned. During the present year there have appeared several discussions of the subject which merit especial attention.†

Professor Tôrnebohm estimates for the Swedish government the iron ore reserves of the world by countries, based on detailed figures for the individual districts, as follows:

	Tons.	Metallic Iron. Per Cent.
United States	1,100,000,000	45 to 67
Great Britain	1,000,000,000	25 to 34
Germany	2,200,000,000	30 to 45
Spain	500,000,000	40 to 56
Russia and Finland	1,500,000,000	20 to 65
France	1,500,000,000	
Sweden	1,000,000,000	50 to 70
Austria-Hungary / Other countries	1,200,000,000	
Total	10,000,000,000	

Many will be surprised at the high figures given for the reserves in Great Britain and European countries. So much is heard of our own vast reserves and of the low grade of some of the foreign ores that we have come to think of the supply outside of North America as relatively small. The position of the United States is somewhat better than shown in the table when we take into account the grades of ore. By multiplying the figures by the average percentages of metallic iron given for each of the countries by Professor Tôrnebohm the result is as follows:

	Tons of Metallic Iron.
United States	603,166,600
Great Britain	295,000,000
Germany	825,000,000
Spain	249,375,000
Russia and Finland	637,500,000
Sweden	611,538,460

It is believed that the reserves for the United States, and hence the total, are higher than indicated in this table, but before taking up this question, we may consider conclusions that may be drawn from the figures as they stand.

President Hadfield of the British Iron and Steel Institute has prepared a diagram showing the world's increase of pig-iron consumption since the fifteenth century and the projection of this rate for the next century on the rate of the last thirty years. If the same rate of increase hold for the next century as has held for the last thirty years, in the year 2,000 the world's annual consumption of iron will be three and one-fourth times its present consumption. The total world's supply of iron ore now known, given as 10,000,000,000 tons by Tôrnebohm, will be exhausted in about fifty years. If the total be correct, about one quarter of the world's known reserves have been used to the present time.

It is argued that the calculated rate of increase is not improbable because of the increased rate per capita of the countries now using iron, because of the normal increase of the population of these countries, and because of the extension of the uses of iron through a much larger proportion of the world's population than now uses it (12½ per cent.). If 38 per cent. of the world's population were to require iron in the year 2,000, this would account for the calculated increase of consumption.

However, this additional part of the world's population, especially in Asia, may find its own iron ore supplies. No one would doubt that the world's reserves will be greatly increased by new discoveries in these relatively unexplored parts of the world.

Judging from the history of the development of the iron ore industry to the present time, the reserves of unexplored countries are likely to be developed only so fast as the population requires it. In this case, such new discoveries will not figure in the reserves available to the countries at present producing iron ore. The generalization might perhaps be made that each continent must ultimately depend on its own resources of iron ore and cannot count, to any large extent, on drawing supplies from other parts of the world.

It is of interest to apply the same method of calculation used for world's supply and consumption to the United States. If the rate of increase of consumption be projected for the next one hundred years on the basis of the increase for the past thirty years, that is, the period used by President Hadfield, and the lines superposed upon his diagram, it would appear that the rate of increase of production for the United States is greater than that of the world. Also the rate of production for the United States is greater than that of any other country. With the total reserve of iron

* Press reports of an address by the writer before the Chicago Geographic Society contain incorrect quotations concerning iron ore reserves. The substance of the writer's statements, so far as they touched on iron ore reserves, will be found in the accompanying paper, the purpose of which is to show that current estimates point to a short life for iron ore reserves, but that these estimates are low and, for the United States, do not take low grade ores sufficiently into account; that these low grade ores must be soon counted as a part of the reserves; that the increased use of low grade ores which this situation seems to call for will cause economic changes in matters related to the iron ore industry.

† Presidential address, by R. A. Hadfield. Delivered at the annual meeting of the Iron and Steel Institute at London, May 11, 1905. *Journ. Iron and Steel Inst.*, Vol. LXVII., No. 1, 1905, pp. 27-106.

"The Iron Ore Supply of the World," by Professor Alfred Tornebohm, *Teknisk Tidskrift*, September, 1905. Translated in *The Iron Age*, November 2, 1905, pp. 1158-1160.

"The Exhaustion of the World's Metals," by N. S. Shaler, *International Quarterly*, Vol. 11, 1905, pp. 230-247.

"A Word Survey of Iron and Steel, by J. Stephen Jeans, Secretary British Iron and Steel Institute.

"A Blue Book of Iron Ore Deposits in Foreign Countries," by Llewellyn Smith. Compiled at the Board of Trade from diplomatic and consular reports, London, 1905.

ore in the United States estimated by Tôrnebohm at 1,100,000,000 tons, the supply would be exhausted in less than twenty years if the calculated rate of increase of production holds. With the reserve estimated by Tôrnebohm, up to the present time 39 per cent. of our total supply has been used, and 29 per cent. has been produced during the last thirty years.

The late Edward Atkinson estimated that if the per capita consumption remains the same, the average annual increase in population of two millions for the United States calls for a yearly increase of pig iron of half a million tons, and that when the probable increase in per capita consumption is taken into account, the total production of the United States will increase at a considerably greater rate.

Professor Shaler concludes that the iron ore supplies of the United States are not likely to last for more than a century.

A great bulk of the known reserves of the United States is in the Lake Superior region. Tôrnebohm assigns a billion tons to the Lake Superior region, and these figures, while probably small, are in accord with many current estimates. In the producing Lake Superior iron districts exploration has, for the most part ,been sufficiently thorough to make it certain that no large increase of reserves is to be expected. In the Mesabi Range, for instance, thirty thousand drill holes and pits have been sunk. The Lake Superior iron districts, however, make up but a small proportion of the region tributary to Lake Superior, constituting less than four per cent. of the land area included in the United States Geological Survey's map of the Lake Superior region. In the remaining 96 per cent. there are still large possibilities for finding iron ores. The greatest of the ranges was discovered as late as 1891 and within the last four years two entirely new ranges have been found, though neither of them yet of the first importance. The geological conditions are such as to warrant the belief that more may be found. At the present time exploration in areas intervening between the ranges and in outlying areas is being pushed vigorously, showing the faith of iron men in further possibilities in this direction. The most sanguine, however, would scarcely hope to find ores equal in amount to those already known.

Lake Superior geological conditions are known to extend northward and northeastward through Ontario, suggesting an important source of supply here. The present known iron ore supply of this great region, counting even ores of low grade, does not equal the reserves of one of the older Lake Superior districts, such as the Marquette, but the country still to be explored is so vast that it is not unreasonable to suppose that important iron ranges such as those of the Lake Superior region may be found. Nevertheless, it is true that nowhere in the Lake Superior country where an equivalent amount of exploration has been done have the results been so disappointing.

When the present high grade deposits of this and other countries are exhausted, the future demand for iron ore is likely to be met by the use of far lower grades than are now considered commercially profitable. The term "ore" is a relative one. With the conditions in Alabama a rock containing 36 per cent. metallic iron may be mined as ore, while in the Lake Superior country such rock is now of no value as an ore. The ferruginous cherts and jaspilites, making up 95 per cent. or more of the iron formations of the Lake Superior region, average between 25 and 35 per cent. in metallic iron, and show all gradations into the iron ores. At the present time ores running below 45 per cent. are but rarely shipped. If the time should come when 30 per cent. ore could be used under the Lake Superior conditions, the tonnage available would be something enormous, perhaps twenty or more times as great as the present supply. It should be remembered that these ores are high in silica, and therefore not as desirable as ores of the same metallic content containing calcium carbonate in the gangue as do the Alabama ores. Moreover, the great distances from blast furnace centres, on the assumption that these remain approximately fixed, will put the low grade Lake Superior ores to a disadvantage in the matter of the cost of transportation.

Tôrnebohm estimates the amount of ore now available in the southern Appalachians at 60,000,000 tons. The Clinton red hematites make up the bulk of this tonnage. Drilling has shown that the presently worked deposits extend with slightly leaner but uniform composition in thin even beds over enormous areas, and it is altogether likely that the tonnage of these ores is many fold the figure given.* The ores are low grade and the cost of mining will greatly increase when the larger reserves are tapped.

The Clinton ores extend along the Appalachians into New York and appear again in Nova Scotia and Newfoundland. In each of these localities extensions are likely to be found. At Belle Isle, Newfoundland, approximately 30,000,000 tons of iron ore are available. This body is known to extend under the ocean, and if it can be successfully mined there, a large additional tonnage may be secured.

The brown ores of the eastern United States are difficult to estimate. They are usually low grade, mixed with clay, and often lie in thin and irregular beds, but the aggregate amount is large.

The magnetites of the Adirondacks and New Jersey are not included in Tôrnebohm's figures. Here again the tonnage is large, and if attempts at magnetic separation are successful on a large scale, as they seem likely to be, we have here another important source of iron ore which has not been taken into account in these estimates.

The titaniferous magnetites will be another important source of supply when they can be profitably smelted.

Unexploited iron ore deposits are widely distributed in the western United States and extravagant estimates of tonnage have been reported, frequently due to the fact that the basis of comparison has been the comparatively small size of the precious metal deposits of the West. The writer has examined deposits of reputed large size where the true tonnage seemed to him to be measured in units of thousands rather than millions or tens of millions. The grade of these deposits is on the average not high as compared with Lake Superior deposits and there is frequently a high percentage of phosphorus and sulphur. Nevertheless, there is in the aggregate through the western states a very large tonnage of iron ore of present commercial grade.

Among the better known deposits might be mentioned those in the Hartville district of Wyoming and in Fierro, New Mexico, both of which are now being drawn upon, in Pitkin, Chaffee, Saguache, Lake and Gunnison counties, Colorado, in Iron county, Utah, in northeastern Washington, and in a number of localities in the Great Basin region of Nevada and California. There should be included also the ores of Vancouver and Texada Islands in British Columbia, which are

* E. C. Eckel estimates 1,000,000,000 tons of red ore above the thousand-foot level in Alabama alone. (Engineering Magazine, Vol. XXX., 1906, p. 521.)

largely controlled by American capital and will be used in the United States. The same remarks may apply to the Durango and other Mexican deposits. With few exceptions, the western ores occur along the contacts of intrusive igneous rocks and limestone, and the extent to which the ores follow the contact in depth has not been shown. Hence the estimates of tonnage vary within very wide limits. The iron ore deposits of Iron county, Utah, are among the larger and most typical of this class of ores. Here some eight hundred pits have been sunk and it has been possible in recent detailed mapping to estimate with a reasonable approach to the truth the amount of ore of all grades appearing to the depth shown by explorations or natural exposures. Using the Utah deposits as a basis of comparison, and excluding the Mexican deposits which the writer has not seen, the tonnage of iron ore of all grades in each of the better known districts of the west and adjacent parts of British Columbia would not surpass that of one of the older Lake Superior ranges, but it is extremely likely that as deep exploration of the presently known deposits continues, and as further deposits are found, as they undoubtedly will be, that the aggregate tonnage of ore in the west will equal a considerable part of that of the Lake Superior region, and one would be rash to conclude that it is impossible that an amount of iron ore may be found in the west fully equivalent to that in the Lake Superior region.

If these data approximate the truth, there seems to be little cause of alarm that North America will really suffer for lack of iron ore for a considerably longer period than required for the exhaustion of the presently known tonnage, as estimated by Tôrnebohm and others, at the present rate of increase of production. The time of exhaustion is not likely to come before that calculated on the same basis for the world's reserves, and probably not then. It may be argued that the use of lower grade ores in Europe and England than in the United States is itself evidence that the exhaustion of reserves is farther in the future for the United States than for Europe or England. But as it becomes more and more obvious that the end of the supply of higher grade ores in the United States is not indefinitely in the future and may even be within a single lifetime, there is likely to be an increase in the tendency to conserve the higher grade ores, and especially the Bessemer ores, and draw more largely on the lower grade supplies, a tendency favored by the concentration of control in a few hands. This tendency has already become well defined as shown by the fact that pig iron production has not in recent years increased as rapidly as iron ore production. It is not at all unlikely that even the next decade may see important changes in this direction. This will give value to properly located low grade ores. It will ultimately mean higher cost for iron, changes in the relative importance of processes for conversion of iron, possible changes in the geographic distribution of different phases of the iron industry, and a modification of the relations of the North American iron trade with that of the rest of the world.

Professor Shaler concludes* that when the higher grade deposits of the world have been exhausted "the cost of production will gradually increase as the lower grade ores and those remote from coal come into use. In the end we shall have to resort to concentrating processes by which the iron ore is separated from the rock in which it is disseminated as grains. This upward grade in cost means a downward grade in the utility of the metal in the service of man. Finally, it may be some centuries from now, but surely we shall be forced to an economy in the use of the metal such as was exercised by folk two hundred years ago, when, save for what went down at sea, or rusted back to earth, none of it was lost to the arts. In this stage, when it becomes again a precious metal, iron may continue to be the helper of man for an indefinite period, but its power for help will be greatly diminished."

International Quarterly, Vol. II, 1905, pp. 230-247.

Others have reached similar conclusions as to the relatively early exhaustion of the ore deposits, few venturing to predict a longer life for the known deposits of more than one hundred years. The strenuous efforts of larger interests in recent years to secure ore deposits and to explore ore-bearing fields are evidence that the possibility of the early exhaustion of the ores is appreciated by many of the companies most concerned.

The situation is probably not so unfavorable as the above estimates would indicate. The assigned rate of increase of production may be too great, for the development of the iron industry of the United States for the past thirty years has been a phenomenal one. On the other hand, it is scarcely safe to predict a lessening rate of increase, for during the past fifty years it has been thought many times that the increase of rate was checked.

Törnebohm's estimate of the total reserves of iron ores for the United States is very conservative, and probably should be greatly increased. His estimate is confined to the producing districts and leaves out of account many important extensions of the ore deposits and districts, many known deposits of good size and quality not now mined because of location or other causes, and large reserves of ore which in the United States are regarded as too low grade to be of present commercial value, but really of a higher grade than ores counted in the English and German reserves. There should also be included the iron ore resources of Canada and Mexico immediately adjacent and accessible to the United States, already largely controlled by American capital and probably to be used in part in the United States.

The ultimate iron ore resources of North America are still far from known, but there may be no harm in reviewing our present imperfect state of knowledge concerning them.

ONCE MORE AFIELD.

Now that the summer is almost upon us, the staff of the Geological Survey are preparing for the season's field work. The appointment of a new director naturally creates more than ordinary interest this year as to how that work is to be apportioned. Several parties are being sent out, and every province of the Dominion seems to be fairly treated. Of the most important work to be done we cite the following items:—

INVESTIGATING NEW BRUNSWICK'S RESOURCES.

The area to be explored by Mr. R. A. Johnston in central and northwestern New Brunswick will be essentially confined to a narrow strip on either side of the proposed route of the National Transcontinental Railway. Trial lines have been run by the railway engineers over the whole distance, but the routes to be used over some sections have not been decided upon, more particularly the section from Grand Falls southeastward to the neighbourhood of Boiestown. The work to be performed over the area in question will consist in an examination into its general geological and natural features and mineral resources.

In addition to the work thus cited, Mr. Johnston will, as opportunity permits, continue his investigations into the subject of Canadian meteorites, with a view to making the bulletin thereon as complete as possible. It is not at all improbable that several of these bodies are in the hands of private parties, where they remain merely as curios, and many more, no doubt, remain partially or wholly buried in the soil of the earth's crust.

Parties, therefore, knowing anything of the whereabouts of any of these bodies, or who may have such in their possession, would confer a great favour by communicating information regarding the same to Mr. Johnston without delay, by whom such favours will be greatly appreciated.

DEEP BORING IN NOVA SCOTIA.

Mr. Fletcher will visit and report on the borings being undertaken by private companies north of New Glasgow and elsewhere. It is the intention of the government to aid in the deep boring operations at New Glasgow and Mr. Fletcher will see that proper records are kept of the cores, and will also verify the depths sunk and the distance bored during the coming season.

The present depth of this boring, which is being put down by cable drill. is about 3,100 feet. The object of the work is to penetrate the conglomerate formation that is supposed to overlie (hereabout) the coal measures.

Application has been made by the Newfoundland Government for the services of Mr. Fletcher who, should the application be granted, wille examine the coal deposits of that island.

COAL IN THE ROCKIES.

Mr. Dowling will be employed during the coming season making explorations in the eastern portion of the Rocky Mountains, between the Red Deer River and the Athabaska. From the Red Deer the extreme northern end of the coal basin that is being mined as far south as Canmore, will be mapped out, and other basins within the above mentioned area will be sought for. It is in the disturbed area of the Rocky Mountains that the hardest and best coal is to be found, so that it is important to ascertain all the possible coal-bearing areas so situated.

The building of new lines of railroad through these northern passes has drawn attention to this very little explored portion.

IN SOUTHERN NEW BRUNSWICK.

The work about St. John, N.B., by Dr. Ells will comprise a detailed examination of the several geological formations there exposed. These range from the lowest crystallines, usually styled Laurentian, through Huronian and Cambrian, and, with some gaps, into the Lower Carboniferous. Certain of the Huronian rocks between the city and Loch Lomond resemble in character those of the Silver-Cobalt belt between Sudbury and the head of Lake Timiskaming, though no trace of economic minerals have yet been found in this part of the province. The Cambrian and Devonian rocks about the city are specially fossiliferous, and large collections have been made from time to time, more especially of the former, by Dr. G. F. Matthew, who has made a special study of these ancient fossiliferous rocks.

Geologically the field is a most interesting one. The map will be compiled on a scale of one mile to the inch, and will extend from the vicinity of Musquash harbour on the west to Black river and Loch Lomond on the east, while northward it will include the lower portion of Kingston peninsula.

GOLD IN NOVA SCOTIA.

E. R. Faribault will continue the examination and surveys of the gold-bearing rocks of Nova Scotia.

The revision of the structural geology of the region lying to the northwest of Halifax and extending to Windsor and Chester, will be made in order to prepare for publication the eight map-sheets completing the counties of Halifax and Hants. The surveys in Lunenburg and Queen's counties, already well advanced, will also be resumed. The surveys of the gold-mining districts of Miller lake and Clam harbour will be completed, and examination will be made in the gold-mining districts already mapped to bring the information concerning them to date so as to assist, by advice, in their future development.

Of Mr. Faribault's work, the "*Journal of Geology*" says: "This work will be of immediate practical advantage to mining men, some of whom have already testified to its accuracy and value. It is another instance, lately of frequent occurrence, of geological work done from a purely scientific standpoint having direct economic value. From a scientific standpoint also, the results are of interest as illustrating a principle of ore deposition in the form of saddle veins along anticlinal folds."

TO EXPLORE KEEWATIN.

Mr. McInnes will be engaged during the coming summer in an exploration of the country lying between the Saskatchewan and Upper Churchill rivers, for the purpose of ascertaining the general capabilities and possibilities of this section of country, both from geological and agricultural standpoints.

Particular attention will be given to the occurrence of economic minerals and to outlining any belts that in their lithological characters or geological relations are similar to known mineral-bearing areas in the east, such as the Sudbury and Cobalt districts.

This country is of special interest at the present time owing to the fact that the projected line of railway from the Saskatchewan to Hudson Bay passes through it.

HYDRAULICKING IN THE YUKON.

Urgent demands are being made upon the Dominion Government for assistance in expensive schemes of transporting water many miles in pipes to Bonanza and Hunker creeks in order to work hydraulicly the auriferous bench gravels found in the banks of these streams.

These water propositions are all "in the millions", and great care will be required to test their feasibility and value before the country is committed to granting them aid.

The Minister of the Interior, who visited the Yukon last summer, takes great interest in this matter, and in order to arrive at a proper understanding of the problem, is sending out a strong party from the Geological Survey with instructions to make as close an estimate as possible of the volume and value of the gold-bearing high level gravels remaining in the banks of the creeks.

Mr. McConnell, who has had several years' experience in Klondike, will be in charge of the party, and will be assisted by Messrs. Keele, Maclaren and O'Farrell. They will make accurate surveys of the banks by cross-sections and by digging test pits and drifts at close intervals along the sides of the valleys; in this manner, assisted by records of claims now being worked they will collect information sufficient to arrive at a close approximation of the cubic contents of the gravels remaining in the benches.

The valuation will be determined from the data already afforded by worked and working claims, supplemented by panning of the dirt from test holes and trenches.

Mining engineers who have visited the district claim that from 6 to 8 cents per cubic yard would give a payable return, and, in comparison to the small returns—sometimes only 2 and 3 cents—that are made profitable in the United States and New Zealand, these figures seem reasonable enough. Much, however, depends on the cost of transporting the water, and the frozen nature of the ground; the catchment basin is sixty miles from the area to be treated, the cost of pipes, dams and flumes will be immense, and until Mr. McConnell furnishes his report, it would be un wise to take a figure on which estimates could be based.

THE ROSSLAND DISTRICT.

The work of the Geological Survey party under the charge of Mr. Brock at Rossland is to be completed during the coming summer, and a monograph, accompanied by numerous maps, plans and illustrations on this important mining camp, will be published as soon as possible after the completion of the field work.

This is the first important investigation of a detailed character undertaken by the Survey, of a mining camp of British Columbia, and the excellent results already obtained from it will surely call for similar investigation of other important camps in that great mining province.

The investigations require an accurate topographical map of the Rossland area, and this is being made, on a large scale, by Mr. Boyd, while Dr. Young is carefully tracing out the intricate surface geology and collecting specimens of the almost endless variety of rocks found there; to map the position of these accurately it is necessary to examine almost every square yard of the surface.

To Mr. Brock is allotted the underground geology. This entails the careful examination of the walls of all the accessible openings and workings, old and new, in every mine on the camp; these shafts, levels and workings aggregate dozens of miles in length, and as the walls are everywhere covered with dirt and smoke, an examination can only be made foot by foot, by chipping fresh surfaces with the hammer. This work is not only tedious but often dangerous in those workings where the timbering has either been removed or has become rotten, and where a light tap of the hammer may bring down large masses of rock from the roof. The ladders in these old workings are liable to rot, and many a slip is occasioned in this manner.

The result of last season's work justifies the undertaking, showing as it does, that the enrichment of the ores came from below, and, in consequence, there is little danger of their value decreasing in depth, as happens when the enrichment of the veins is due to descending waters.

The investigations on the treatment of the lower grade ores point to a satisfactory solution of their treatment, and everything tends to show that Rossland will once more assume its old standing as a camp, but without the accompanying evils of a mining "boom."

The fortunes of this camp were, as is well known, at a particularly low ebb some two years ago, and both managers and directors were becoming discouraged. It does not in the least detract from the excellent work done by the mine managers when it is affirmed that it was largely on the advice and encouragement given by Mr. Brock that the present successful development and exploration work has been undertaken.

Mr. Brock's preliminary report has been printed, and is now being bound, and should be issued within a week.

FOSSILS—THEIR UTILITY.

Nearly every one now recognizes the fact than an intimate connection exists between a thorough scientific knowledge of the fossil remains of any series of sedimentary rocks and the economic results arising from geological study. Each set of rock deposits has its distinctive fossils, so that the greater our knowledge of the organic remains preserved in the rocks, the more readily can we distinguish the various geological horizons—a result of particular importance in this country in connection with the discovery of coal, petroleum and allied mineral products of commercial value.

Mr. Lawrence Lambe, Vertebrate Palæontologist to the Geological Survey, has in preparation a report on the fossil remains of the Oligocene deposits of the Cypress Hills, or in other words, on the animals, principally mammals, that lived in our western country during a past age known to geologist as the Oligocene or earliest Miocene period. Only remnants of the deposits then formed have escaped the action of the weather, and are found in isolated patches, of which one, capping the Cypress Hills in Southern Saskatchewan, has yielded the evidences of past life at present being studied. This part of the country then enjoyed a climate much milder than the present one, and was composed of plains and uplands, lowlands and forests with rivers flowing rapidly from the west and flooding the lowlands. The animals of this period were varied, and belonged to a number of groups. That the number of individuals in some of the groups was large is evident from the number of fossil remains of some forms. Some of the groups have since become extinct, others have undergone great changes, and are with difficulty recognized in their descendants of the present day, whilst a few now exist with but slight differences of form and structure. Included in the Cypress Hills collections are remains of ancient cat fishes, gar-pikes, and of a species like the modern mud-fish. Of reptiles there were land and water tortoises and river turtles, as well as lizards, snakes and crocodiles. Mammals, however, then preponderated as now, such as numerous kinds of hoofed mammals (Ungulates), to which ordinary English names are not applicable. Some of these may be briefly mentioned, however.

Among the even-toed Ungulates were a pig-like animal of large size, a distant relative of the true pigs; animals of the size of sheep that evidently lived in herds on the borders of lakes; small animals from which deer are supposed to be descended, with a number of other forms. The odd-toed Ungulates were represented by a variety of small primitive horses, swift running types of rhinoceros, also small hornless rhinoceroses with light limbs, and Titanotheres, extinct as a family, some forms of which were as large as elephants and which bore a pair of horns set transversely on the snout or in advance of the eyes. The squirrel family is represented, also early beavers and primitive hares.

The flesh-eaters included a number of primitive Carnivora, of which the largest and most powerful known left its remains in the Cypress Hills. Its jaw was more robust and stronger than that of any flesh-eater at present living.

Forms were also living that were the early representatives of our cat and dog tribes, and small insect-eating animals thrived. It may, in fact, be said that every class of animal now living had its primitive ancestors then on earth. From the latest collection of fossil vertebrate remains made by Mr. Lambe in the Cypress Hills beds, we have more than doubled the list of species known to have lived during Oligocene times in what is now part of western Canada.

During the coming summer Mr. Lambe will be engaged in examining certain Tertiary deposits of the southern interior of British Columbia with a view to gaining a better knowledge of their exact geological horizons. The fossils obtained will, it is hoped, form a desirable addition to the collections of the Survey, to be available later for exhibition purposes in the new building of the Geologieal Department.

COPPER DEPOSITS OF THE EASTERN TOWNSHIPS OF QUEBEC.*

By John Alexander Dresser.

INTRODUCTION.

The name "Eastern Townships" is applied to that portion of the Province of Quebec which is comprised in the northward extension of the Green Mountains into Canada. The hilly character of this district and its less accessible position delayed its settlement until nearly forty years after the cession of Canada to England. It was then surveyed according to the English mode of division of lands into townships that are approximately square, instead of the narrow ablong parishes of the French method of survey.

The Green mountains in Canada are sometimes known as the Notre Dame Hills. They determine the eastern edge of the flat St. Lawrence valley, and extend northeastward from the boundary line between Vermont and Quebec for a distance of about one hundred and fifty miles, or nearly to the latitude of Quebec City. The highlands of Gaspé, commonly called the Shickshock Mountains, are the extension of the White Mountains of New Hampshire, or of some more easterly range of the Appalachian system. From these the hill country of the Eastern Townships is separated by a considerable interval.

The main geological features of the district are three belts of crystalline rocks which are probably pre-Cambrian in age, separated by Paleozoic sediments, which are almost wholly of pre-Devonian age. These relations may be clearly understood by a glance at the map, Fig. 35. The crystalline rocks are composed of altered sediments, tuffs, and true igneous rocks. The igneous rocks consist of a series of porphyries and andesitic rocks, and of a serpentine-diabase series.

* From Economic Geology. Vol. I, No. 5, April, 1906.

THE ORE DEPOSITS.

MINING IN THE EASTERN TOWNSHIPS.

The occurrence of copper in the Eastern Townships was known as early as 1841, in which year Sir William Logan examined a copper property at Carbuncle Mountain, Brompton Lake. This was one year prior to the organization of the Canadian Geological Survey of which Logan was the first director.

In 1847 the Geological Survey report called attention to the deposits at Upton, and the reports of succeeding years mentioned or described other localities, until a compilation of those in 1866 gives a list of about five hundred localities in which copper was known to occur in the district. This mineral was vigorously sought for and extensively mined between the years 1859 and 1866. With the decline in the price of copper which followed this time, from about thirty-five to nine cents per pound, the mining operations received a very severe check and work for a time almost ceased.

In this earlier work copper was the only product of the ore that was of any considerable value, and the richest sulphide ores were discarded when the percentage of copper was low. After the intense speculative wave had passed, notwithstanding the low price of copper, between 1875 and 1885 several properties were reopened or changed management and were worked on a better economic basis. Not only were the metallic contents of the ores, except the iron, utilized, but the sulphur was also saved for the manufacture of sulphuric acid and allied products. Thus some of the reopened properties have been worked continuously for about thirty years, *i.e.*, ever since their operations have extended to the utilization of the sulphur. A depth of three thousand feet, or thereabouts, has been reached, and although detailed reports are not available, the continually increasing scale of operations at least indicates no diminishing of the works at these well-managed and successful mines.

CLASSIFICATION OF THE DEPOSITS.

The copper deposits of the Eastern Townships are of three distinct classes:

1. Ores, chiefly chalcopyrite, with small amounts of chalcocite and bornite, and relatively unimportant amounts of other ores, principally carbonates and pyrite. The ores of this class occur in the porphyry-andesite schists, the oldest rocks of the region. They form lenticular bodies, apparently occupying crevices, or more likely, have replaced the rock along lines of weakness produced in the course of the intense folding to which the region has been subjected. The gangue, when distinct from the country rock, is generally quartz, though sometimes calcite.

2. Chalcopyrite, bornite and chalcocite, with small amounts of carbonates compose the deposits of the second class. These occur as irregular bodies in Cambro-Silurian sediments where the latter are invaded by certain intrusives. The gangue is largely calcite.

3. Chalcopyrite in pyrrhotite, with a little pyrite, forms the third class. The deposits of this class are situated along the contact of Cambro-Silurian strata with the intrusive diabase of the serpentine series. They are distinguished from the ore bodies of the second class, not only by the character of the ore and the presence of pyrrhotite, but apparently also by the fact that the second group are generally exomorphic contact bodies, while the third are principally

endomorphic features of the contact. Moreover, the intrusives of the former are only dikes of comparatively small volume, but those of the latter class are large mountain-forming masses. The country rock of the second class of deposits is limestone wherever they have shown any important dimensions, with one possible exception, but in the third class it is an iron bearing slate or other metamorphic rock of the district.

A few of the characteristics of the ore bodies of the first class only will be presented in this paper.

CHALCOPYRITE AND PYRITE DEPOSITS.

Distribution.—The deposits of this class include the principal basis of work in the early development of the district, and of all the ore bodies that are at present exploited. They comprise three principal groups:—

(*a*) Some fifty mining properties and prospects, of more or less promise, in the township of Ascot, and other townships near the City of Sherbrooke. Amongst these are the Eustis, Capelton, King, Suffield, Ascot and other less known properties.

(*b*) The series of deposits long known to extend through the townships of Sutton, St. Armand, Bromo, Shefford, Ely, Melbourne, Cleveland, Shipton, Tingwick, Arthabaska, Chester, Ham, Wolfestown, Inverness and Leeds, as well as the divisions of the seigniory of St. Giles, known as the Handkerchief, and Ste. Marguerite in the county of Lotbinière.

(*c*) Deposits in the little known district along the boundary line between the province of Quebec and the state of Maine, south and east of Lake Megantic.

It may be seen by reference to the accompanying map (Fig. 35) that these groups are in the form of belts, which have a general northeasterly trend and are approximately parallel. For convenience they may be designated as the Sutton, the Ascot, and the Lake Megantic belts.

Dimensions and Relations to Enclosing Rocks.—In all cases the deposits occur in, or in close association with, altered volcanic rocks, generally of the porphyry class. The country rock is always highly folded, and often twisted and contorted to a remarkable degree, and this deformation gives to the ore deposits their characteristic shape. In form the deposits are much flattened lenses, which lie in conformity with the foliation of the rock. They are arranged *en échelon* generally along zones of extreme foliation. The individual lenses seldom exceed twenty or thirty feet in width, and bodies of these dimensions would be approximately two hundred to three hundred feet in length, according to approximate generalization from observation of a considerable number of the smaller lenses, and from the experience of miners who have worked out many of such bodies. The third axis, that nearest the vertical, follows the dip of the foliation, but its length relative to the other axis is not easy to ascertain, even approximately, since it is only these lenses which lie wholly beneath the surface, and which have been wholly worked out that can give data of any value, although a depth of nearly three thousand feet has been reached. Opportunities for such observation are necessarily rare. Experienced miners seem agreed that the dimension of these bodies in the direction of the dip is sometimes greater, at others less, than the horizontal axis, and some are of the opinion that it is generally greater.

The arrangement of the ore lenses *en échelon* is a matter of much importance in following the ore bodies. Thus in the Capelton district the miners have learned when a lens is exhausted to drift to the *right* to find the next. That is, that in proceeding along the strike towards the northeast, each succeeding lens appears on the southeast side of the previous one, *i.e*,. in the hanging wall, and in going towards the southwest the next ore body is to be looked for on the northwest, or in the foot wall. The dip here is from forty to seventy degrees towards the southeast.

The ore bodies correspond in their arrangement with the order of the hills of the district, and with the general structure of the Appalachian mountain system, in which each range when followed northward is succeeded by another lying to the east. It is evidently the same orthographic feature which gives the Atlantic coast its general northeasterly trend.

Though rarely, the ore bodies occasionally cross the planes of foliation of the country rock. They then have the aspect of veins running slightly oblique to the strike, or more rarely, to the dip of the enclosing rock. These vein-like masses are, however, of very limited extent, and are probably only the filling of local fractures between larger shearing planes. They are, perhaps, the better developed of the minor series of fracture joints.(1)

The walls of the ore bodies are not usually well defined, though one is usually more definite than the other. The ore, which consists essentially of chalcopyrite in pyrite, grows poorer towards the edges of the bodies where there are no definite walls, until the proportion of ore in the country rock becomes so small as to be imperceptible.

Origin of the Ore.—From the evidence at present available it can only be said that these ores were primarily brought in by the volcanics in which they are generally found; that the subsequent folding and shearing of the rocks developed planes of easier passage in which the subterranean waters, leaching out the metallic minerals from the rock, deposited them by replacement. The better preserved wall on one side of the ore bodies may be due to the fact that the rock on that side of the shear plane was more highly fractured than on the other, as is often the case. The greater replacement would thus take place on the fissile side of the water-bearing crevice. After the first film of ore had been deposited, a protection was afforded by it for the rock face on which it was deposited and all further replacement was likely to occur on the more fractured side.

The common occurrence of chalcopyrite in crevices within the pyrite, and as a thin layer upon a joint face seems to indicate that the chalcopyrite was introduced later than the pyrite. But of this there is not enough known as yet to speak decisively. Actual crystal replacement has not yet been observed.

Value of the Ores.—The average of a large number of assays of specimens from the south side of the Capelton hill, *i.e.*, from the Eustis and Capelton mines and other properties of the vicinity, showed the copper to range from 4 per cent. to 5 per cent., sulphur, 38 per cent. to 40 per cent., and approximately one ounce of silver to each unit of sulphur, with small amounts of gold.(2)

A number of assays of recent date from the north side of the same hill, from the Suffield, King and other properties, give a lower percentage of sulphur, but higher metallic values, especially of silver, which here seems to vary without regard to the sulphur. Gold is here commonly present to the amount of $2.00 to $4.00 per ton. As a very general statement the

(1) J. B. Woodworth, *Proc. Boston Society of Natural History*, Vol. XVIII., p. 391, 1896.

(2) Dr. R. W. Ells, Geol. Survey of Canada, 1888-9, p. 53 K.

ores of this class of deposits may be said to carry 4 per cent. of copper, 35 per cent. of sulphur, near the surface, and at greater depths to yield uniformly 3 per cent. of copper, 45 per cent. of sulphur, three ounces of silver, and small amounts of gold.

Gold, which does not seem to be present in appreciable amounts at lower levels, is often an important factor near the surface. Alluvial gold occurs in many of the streams which run over copper-bearing rocks, and the surface rocks yield it in many places. At a depth of a few feet from the surface most such gold prospects have been abandoned, but in one or two notable instances they have developed into copper mines, the copper values increasing as the gold values declined.

Secondary Enrichment.—Although it has not yet been found possible to get information sufficiently definite and accurate to make a satisfactory comparison of the ores at different depths, there appears to be a slightly higher copper, and distinctly greater gold value, near the surface, than at a depth of a few hundred feet. This richer zone seems to be deeper but less well marked in the case of copper than of gold. The information available, however, is insufficient as yet to admit of safe generalization. At present it can only be said that there probably are such zones, that they are presumably due to secondary enrichment, and that any such enrichment has taken place from above, and hence by means of descending waters. The evidences that both the iron and the copper sulphides were deposited in their present position after the foliation of the country rock began have been already noted.

Source of the Copper.—The source of the copper and other metallic minerals seems undoubtedly to be the volcanic rocks. The principal deposits occur wholly within these rocks, smaller bodies, however, being not infrequently found along the contact of the volcanics with an overlying dolomite. In such cases the copper has evidently been deposited contemporaneously with the dolomite, which it more or less strongly impregnates for a distance of a few feet only from the volcanic rock.

It was recognized by Logan that the copper deposits were derived from the country rock(1). But, on the assumption that the country rock was of aqueous origin, these were regarded by him as an excellent example of sedimentary mineral deposits. He thus summarizes his views.(2) "The evidence which has been presented in the description of the copper deposits of the Quebec Group, appears to show that the metal, like the iron, manganese, nickel and chrome, which so often accompany it throughout these rocks, was held in solution by the waters from which the sediments of the period were deposited. By the agency probably of organic matter it was reduced to the condition of a sulphuret and precipitated with the sediments, either in a finely divided state, or more frequently, in small nodules, or patches, which became interstratified with the limestones, the slates, the diorites and the other rocks of the series. A subsequent action, probably contemporaneous with that which has metamorphosed and crystallized the rocks over a great part of their extent, dissolved out portions of the copper sulphurets from these beds, and in certain cases deposited them with quartz and various spars, in the fissures of the rocks, giving rise to the veins or courses which have been described.

(1) "Geology of Canada," 1863, pp. 734–5.
(2) "Geology of Canada," 1863, p. 734 et seq.

"There appear to be in this region no facts to sustain the ancient notion of the connection of metalliferous deposits with eruptive rocks which are absent from great portions of the district."

With the knowledge that the country rock is eruptive, the above opinion becomes open to reconsideration. And since there seems to be no doubt that the copper has been derived from the country rock, these lodes can only be regarded as deposits genetically connected with volcanic rocks and the earlier view is thus completely reversed.

MORE NOTES ON STAMP MILL PRACTICE*

By Courtenay de Kalb, New York.

This paper may be considered correlative to one on the same subject published in the Transactions of the Canadian Mining Institute, six years ago, representing more varied experience, confirmatory of some of the opinions then expressed, and destructive of others.

SCREENS.

The unwisdom of depending too much upon the diameter of screen opening to determine size of pulp must be again insisted upon. Height of discharge and quantity of feed water are the best regulators. The diameter of screen opening is never constant, owing to wear, and the difference of every 1,000th of an inch is vital. The skilful batteryman will, with a well-mixed (bedded) ore maintain a uniform product throughout the mill, though conditions of weight of stamps and diameter of screen openings may vary widely in the different batteries. Every mill should be provided with at least three testing screens, one having openings equal to the diameter of the maximum size of grain admissible for the ore under treatment, one having an opening equal to the middle-sized product desired, and the third of the finest accurate screen made, which is No. 150 mesh, or about .00876 millimeter diameter of opening. The product from every battery should be tested at frequent intervals by wet screening. When the pulp on the coarsest screen exceeds a half of one per cent. the battery screen in that battery should be changed, or extraction will suffer. The ratio between the middle-coarse and the middle-fine should be nearly constant and uniform throughout the entire mill, and above all a constant ratio by weight between the total oversize and undersize material from the finest screen must be carefully maintained. These ratios should be made the subject of regular reports on the amalgamator's report-sheet to the manager, the same as the daily assays. They are equally as important, for, while the latter indicate values, these ratios have a definite and vital relation to the percentage of extraction which may be anticipated. It is a good plan to throw the responsibility for the screening upon the amalgamator, and for drying, weighing and reporting, upon the assayer.

The perfect screen does not yet exist. Die-cut Russia iron still stands unexcelled for most ores. As a screen should, in the author's opinion, be used as far as practicable chiefly to prevent the escape of

* This paper was read at the annual meeting of the Canadian Mining Institute, Quebec, March, 1906.

grains larger than the pre-determined maximum which can be economically treated, the larger the ratio of open-space to blank metal in the screen the better, and the openings should be so disposed as to facilitate discharge to the utmost. For limiting discharge, regulate weight of drop, height of discharge, and quantity of water. The "herringbone" pattern of diagonal-slot punched Russia iron screens, has been found, in my experience, to combine in the highest degree this advantage, coupled with good wearing power. The Tyler rolled wire screens gives a better discharging surface, but the crown of the mesh is the thinnest and weakest portion in this screen, instead of being the heaviest, and its life is correspondingly shortened. If this screen can be made with the crowns electrically welded, it will be a great boom to the millman. The tendency of the woven-wire screen to clog does not apply to any serious extent to the rolled wire screen.

FOUNDATIONS.

My personal experience with concrete mortar foundations has led me to regard them with disfavor. The surface must be very smooth. It is unsafe to compensate for unevenness in the set of the concrete against a "form," by grouting, as this gives a bearing surface of uneven density. The tendency of concrete mortar-blocks to wear rapidly and unevenly seems irremediable, and will so remain until some one can devise a lock-nut for foundation bolts insuring absolute rigidity. A rubber cushion directly between the mortar and the concrete is a mistake, and in fact merely invites rapid wear, since the inevitable prominences on the concrete surface compress the rubber at those points inducing excessive wear, so that destruction of the cushion soon ensues. Anvil blocks between the mortar and the concrete block increase the difficulty of rigidly anchoring the mortar, and exaggerate enormously the evil tendency of the concrete block to induce breakage of stems. Having had opportunity to compare the behavior of batteries mounted on concrete and on built-up wooden blocks in the same mill, crushing identical ore, and this in two different mills in separate districts, I have in each instance found the ratio of broken stems to be as 1 to 3 in favor of built-up wooden blocks. I have been led to adopt as best a rock or concrete bottom, accurately dressed smooth and level to a straight edge in every direction, as a support for a built-up block of 2" x 10" creosoted white or sugar pine, spiked together, not less than 12', nor more than 14' in height, dressed smooth on top and carrying a ¼" best grade pure Para gum sheet as a cushion against the mortar. Such blocks are good for 8 to 10 years, even where drainage of block-pits is not good. To reduce the wear of concrete blocks I have employed with marked success a facing of ¼" wrought iron sheet, at least 4" wider than the width of the mortar base, and 2" larger. This effectually stops the wear of the sharp edge of the mortar on the concrete if any nuts loosen, and it furnishes a suitable surface for the rubber cushion. This comes very near eliminating the disadvantages of the concrete block, but nuts on foundation bolts will loosen quicker than with wooden blocks, and more stems will break on concrete.

STAMP DUTY.

Stamp duty is relative, depending not only on the character of the ore, but on the rate of discharge which has been found to give the most economical results. The metallurgist who has not advanced to the point of tolerating the low crushing efficiency per H.P. of the stamp mill for the sake of the extraction by amalgamation which he can make it yield, is in error at the very foundation of the trade. If you are not getting your large recovery of gold values inside your batteries, there is something wrong with your methods, or else you ought not to be using a stamp mill, and your whole process needs study and revision. It should be borne in mind that it is not necessarily the mill man who can put through the largest tonnage who is earning the most money. As an example, in a recent experience in California I found that I could obtain a recovery of 91.5% when crushing 0.121 ton per stamp per hour; and that using the same screen (0.028 in. diam. of opening) but readjusting the mill as to drop, discharge, etc., the duty could be run up to 0.188 ton per stamp-hour, with a reduction of the recovery to 77%.

MORTAR LINERS.

A long and trying experience with mortar liners has led to my abandonment of this attractive adjunct to a mill. Theoretically it should be possible by the use of liners to have at command an adjustment of the width and depth of the mortar, thus giving that flexibility which would enable it to meet changing characters of ore. Practically I have found that such great inequalities of wear of the mortar are induced by liners that ere long it is impossible to hold them in place, and so far as the bottom-liner is concerned it becomes a sort of teeter-board, and throws the whole line of dies to one or the other end of the mortar, inducing cupping, and destruction of the ends of the mortar shell itself. A good hard gray-iron mortar, with a base 9" thick, and ends at least 2¼" thick to a height of 10" above the mortar-lip, is the best that can be had. In order to quote low prices, manufacturers design mortars with scanty metal on base and sides. Insist on plenty of metal; it costs little, while demurrage of your mill later on may destroy your profit and ruin your chances of success. In general the narrow mortar of moderate depth (say 14" wide and 6" deep at the lip) is the most satisfactory, in that it will fit more cases. The chuck blocks will then do the rest.

SHOES AND DIES.

While admitting that no rule may be established for all ores as to the best type of shoe and die, I may set forth as the result of my own practice that I find in the great majority of cases the longest life, highest duty, and most uniform and economical wear, are obtained by shoes and dies made as follows: dies, with one inch base, forged steel, made from open-hearth ingots of "80 carbon" (i.e., 0.8% carbon) forged at dark yellow, bases subsequently annealed; shoes, open-hearth "60 carbon" steel, forged at bright cherry, necks annealed. Shoes and dies made according to these specifications year in and year out have worn respectively until the die was ¾" to 1" thick, and the remnant of the shoe was a plaster of steel ⅛" to $\frac{1}{16}$" thick on the end of the boss-head; cupping being so rare as to arouse the gravest suspicions of inattention to duty on the part of the amalgamators. The die should be more highly elastic than the shoe, because the crushing of the ore particles in stamp milling is done as a result of the reaction from the resilient die, the waves of compression transmitted through the particle from the shoe being reflected from the die, and the strains set up by the on-coming and the reflected waves, exceed the elastic limit of the particle, and rupture, to the point even of comminution results. Place two steel bars ½″ thick on a new die, with a 1″ fairly round ore particle between, and let a newly shod stamp drop on it. You will find a number of irregular fragments of varying sizes, with a small conical pile of ore-powder resting on the die very highly compressed in the centre so as to be often adherent to the die. This experiment not unfairly represents what occurs in practice, where the blow delivered upon the protruding larger masses of ore is checked by the expenditure of work in compression of ore particles, until the momentum is overcome by the increasing resistance of the number of uncrushed particles relatively to the remaining kinectic energy of the falling stamp. The crushing of the finer particles, which can never be reached by the stamp, owing to this masking of its blow, is manifestly due to attrition in the mass of pulp, and to minor blows transmitted from the stamp through ore-particles to smaller pieces between these and the die. It is interesting to observe that the percentage of pulp produced in the above experiment, crushing single particles, which will pass through a 0.00876 m.m. opening is roughly 22%, while in ordinary work a mill will produce from 28 to 40% of pulp of this grade.

INSIDE AMALGAMATION.

In some mills the bulk of the amalgam recovered from the batteries is found in the sands; in the Yellow Aster (Cal.) mill, it tends to form hard balls in the corners of the mortar, but this is a rare though not exceptional case. Ordinarily the "catch" is mainly on the plates. It is always good practice to use a chuck plate, unless it persistently scours to have copper. What is caught on this plate is so much to the good, and it costs but little to get it. Usually it is a very productive plate, and should yield hard amalgam in ridges, often a half inch high. It is easier to secure good work on the back plate. Scour will occur sometimes, in spite of careful work, due to unavoidable changes in the mineralogical composition of the ore, rendering the pulp either more or less mobile, and either condition may be a predisposing cause. The tappets may be re-set to compensate, and regulate the splash to check the scouring, but if plates have begun to catch, and then start to scour, it is safer to remove them at once, substituting new ores, and then readjust to bring the splash back to proper form. It is unsafe to count on re-catching scoured amalgam on the outside plates. The inside amalgam should be hard and dry, and such amalgam breaks up into thin scales and spicules which float most persistently. The regulation of the splash is all-important. Even when, as seen through the screen, the splash appears to be an even oscillation or wave-motion across the mortar, it may in fact be scouring. If the plates show much bare copper it means a loss, for amalgam is certainly forming, and is equally being worn away, much of which is inevitably lost. The inside plates must be coated with amalgam, or else they are a disadvantage. The adjustment of a battery to avoid scour cannot be made in a perfunctory manner, nor can it be done according to rule. It is only in rare cases that every stamp in a battery can be set to the same drop, and good results obtained. After a clean up they must be set that way, with the centre stamp having a little higher drop than the others. Then one by one each stamp must be reset until all tendency to scour is overcome. Even then they must be watched, and re-set as the shoes and dies wear, and as the chuck block is dropped, giving a narrower space in which the crushing must be done. If scour is persistent, in spite of such vigilance, it indicates either that the plates are too near or too far from the dies, or that the sands are too mobile ("quick") or too heavy ("dead"). The latter difficulties may be overcome by changing the ore mixtures, which in most mines can be accomplished if enough stoping ground is blocked out. Sometimes a change in the quantity of feed water is all that is necessary. Another difficulty is the obstinacy of many amalgamators who will not attend to all these details, who expect a mill to run itself, and refuse to be taught better. Such men are too expensive to keep.

CONSTANT ORE MIXTURES.

The bedding of ores, so as to secure proper mixtures, giving the best results in milling is almost as important in amalgamation as in smelting; but as the physical character of the pulp is the important thing, which no analysis can foretell, it will not do to "stock" in the bedding-bins too far in advance of the mill-needs. It is better to have ore of different characters broken and ready in the chutes, to be drawn upon as needed.

DRESSING OUTSIDE PLATES.

The experienced amalgamator will never allow discoloration to begin upon the outside plates. The preventive, as well as the remedy, is hard, brisk, rubbing with whisk brooms. Discolored plates indicate laziness, inattention to duty! A dark, crusted deposit, however, indicates antimony, for which there is no effective remedy but to find where the ores carying it come from, and omit running those blocks of ore which give trouble to mill. It is usual to find antimony segregated into chutes or bunches, at least to such an extent that the difficulty may be minimized by intelligent management.

To clean plates borax soap is altogether the best material to use under modern conditions. It is sufficiently alkaline to clean off any stray animal fats, and it will emulsify the mineral oils, and leave the plates bright and ready to take mercury or catch-gold. Caustic alkalies no longer have any legimate place in the amalgamator's stock of supplies. They do not touch the mineral oils, and practically all modern lubricants are petroleum derivatives. Cyanide of potash should never beused under any pretext. It hardens the amalgam and causes it to scale. If bare copper occurs, from any cause, scour with sand, wash with borax soap, rinse, swab with a solution of mercuric chloride (corrosive sublimate) rinse, well, and burnish with a dry cloth. A surface so prepared will promptly start to catching amalgam.

USE OF SALTS WITH COPPERY ORES.

If the ores carry copper sulphides, copper sulphate will usually be present also, or will be formed to some extent in the battery. This may be largely decomposed and the copper amalgamated with the gold, by feeding common salt with the ore. This may be due to the normal reaction between the copper sulphate and the metallic iron in the battery, the salt serving merely to facilitate the reactions and amalgamation by increasing the conductivity of the solution. Further chemical phenomena may be involved, but I have as yet had no opportunity to study the situation critically in the laboratory. This practice is often useful in protecting the cyanide treatment of the mill sands.

OUTSIDE AMALGAMATION.

The hardness of the amalgam for good work no man can determine in advance for any ore. The right consistency must be found out by actual trial in each mill. Usually a granular, frosty appearance, with a softness such that the fleshy part of the thumb can just make an impression, is most likely to give the best results. Abundant area of copper plate beyond the battery is important. Most mills are deficient in this regard. It pays to have enough. Forty eight square feet for each battery may be taken as the minimum and beyond this use as much as pays. There is no advantage in using copper plates plated with more than 1 oz. silver per sq. ft. In fact, more than this is a positive disadvantage. A good amalgamator can build up amalgam on raw copper without difficulty and, keep his plates bright and fresh. The chief advantage in silver plating is to reduce the absorption of gold by the plate. A first dressing on bare copper with dilute silver amalgam will yield a surface more sensitive as an amalgam-catcher than a silver-plated copper plate.

The foregoing statements have been made with the positiveness of conviction resulting from successes in practice wrung out of trying situations, but with no thought that the final word has been uttered, and the author hopes to stimulate criticism and call forth new confessions of experience, to the betterment of his own and others' metallurgical methods.

THE CYANIDE TREATMENT OF CUPRIFEROUS TAILINGS BY THE SULPHURIC ACID PROCESS.*

By W. S. Brown.

The following notes on the sulphuric acid process as applied to the treatment of a cupriferous ore may be interesting for comparison with the results of laboratory experiments on the use of Ammonia and its compounds in cyaniding cupriferous ores, recently contributed by Messrs. Jarman and Brereton.

The ore here referred to, in which the copper is present as carbonate, came principally from the Cobar Chesney Mine, Cobar, N.S.W., and was crushed in that Company's old battery many years ago. The tailings remained on the dump until purchased by Mr. Askin Nicholas, in February, 1903.

Separate acid vats were provided for the preliminary acid treatment. In the operations under review, these vats were shallow rectangular wooden vats each holding about 25 tons of tailings.

The cyanide vats held 75 tons of tailings, so that the contents of three acid vats were treated and subsequently loaded into one cyanide vat. This allowed of a proper adjustment of time of treatment for continuous working and the small acid vats reduced the risk of defective treatment.

On an acid vat being loaded, ten to twelve tons of dilute H_2SO_4 solution were pumped on. As soon as the vat was full of solution, covering over the ore for some inches, the bottom valve was opened and the spent solution allowed to drain off slowly through a launder to the copper precipitation boxes. When the solution had drained so as to show the ore on top of the vat, the bottom valve was again closed for an hour or so and the acid allowed to remain in contact. This first solution when drained off never showed free acid.

On again opening the bottom valve, the balance of the acid solution was allowed to percolate, usually at the rate of about two tons an hour, and flowed directly through the copper precipitation boxes to the sump, for making up again with H_2SO_4, or to waste.

The acid solution was followed immediately by a first water wash equal in tons to the original solution, which flowed into the vat from a tank above at the same rate as the vat was draining. This wash was followed by a clean water wash of about half the quantity and the vat was allowed to drain for discharge, the total time of treatment being 48 hours.

All the acid solution and wash passed through the copper precipitation boxes, and was either used over again or run to waste, depending on the supply of water available. The final wash was always clean water.

When these operations were complete and the vat ready for discharge, 0.5% to 0.8% of lime was distributed over the surface and discharged with the sands, ensuring a fairly intimate mixture.

The acid solution was made up afresh for each vat, and its strength determined from a sample of the sands drawn during loading.

A portion of this sample was agitated for half an hour with a standard 1.5% H_2SO_4 solution, and the consumption of acid determined by titrating with standard Na_2CO_3.

The weight of acid consumed in lb. per ton of sands was then calculated, which, multiplied by the number of tons, gave the total acid required for the vat. To this an excess quantity of 25% was commonly allowed and the weighed acid then added to the sump, well stirred up and pumped on. The pump employed was a Pemberthy steam ejector, which answered extremely well, and lead piping was used.

The copper was precipitated from solutions by passing through two boxes 10 ft. x 3 ft. x 4 ft., each divided into four compartments as in the ordinary zinc boxes. These boxes were filled with scrap sheet iron, obtained locally in the shape of old tins which had been burnt for recovery of the solder, and were to be had for the cost of carting.

The precipitation of Cu on the large surface of iron thus exposed was practically perfect. On the other hand, all free acid entering the boxes was consumed at the expense of the iron.

Before the lime was added, and the vat discharged, a second sample was drawn from the sands. On this sample a determination of cyanide consumption was effected by agitating for half an hour with a 0.3% KCy solution with addition of 0.5 % of lime.

For some time an effort was made to determine the acidity on this sample for regulation of the quantity of lime required, but for various reasons it was found better to add 0.5% lime as a minimum. In special instances additional lime was added.

No regular record was kept of the Cu remaining as a residue after acid treatment, but as a rule the extraction was almost complete. With slimes present in sufficient quantity or unevenly distributed through the sands so as to interfere with percolation, of course the results were not so good.

From the acid vats the sands were trucked to the 75-ton cyanide vats for ordinary treatment.

Fifteen tons of weak KCy solution were first applied to displace the approximate 15 tons brought as moisture from the acid vats. This first fifteen tons carried little gold. As a rule about 12 tons would come through carrying only traces, and the other three tons would vary according to the relative perfection of the displacement. In any case the first 15 tons were carefully isolated in a special sump and eventually used as a

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* A paper read before the Institution of Mining and Metallurgy, London, March 15, 1906.

final wash for the outgoing residues. This solution passed slowly through a zinc box, and then through about 20 cub. ft. of packed charcoal.

The zinc precipitation was not effective unless free KCy was present, showing defective displacement in the vat, in which case there would be high gold values in the solution, but when no free KCy was present and but little gold, the charcoal always caught some, if not all. If assays showed that more than a few grains of gold were still present and precipitation had been imperfect, the solution was again passed through a freshly made-up zinc box, with addition of KCy, before being finally used up as a wash.

The first weak solution was allowed to drain off entirely and was then followed by solution made up to 0.3% KCy. Several applications of this strength were made, in all between 50 and 60 tons being pumped on, but between each application the sands were allowed to drain dry, the outlet valve being only closed when a fresh lot of solution was going on.

Between 20 and 30 tons of weak solution followed, and finally the 15 tons of wash.

The following statement shows the actual working on these lines, and covers the period of from 1st to 16th October:—

in excess of the actual requirement per ton of sands.

The copper present averages 0.32%, or equal to 1.44 tons for 450 tons, 7.1 lb. per ton.

Cyanide consumption is shown as 0.72%, or 1.6 lb. per ton.

From costs taken over several months—

Scrap Iron averaged	1.5*d.*	per ton.
Lime	"	3.6	"
Zinc	"	2.0	"

The quantity of acid used—4.5 lb. per ton, in excess of consumption on the ore—is open to criticism, and could to a great extent have been obviated by a better arrangement. Instead of passing the acid solution direct to the copper precipitation boxes, where the excess of free acid was consumed by the iron, it might have been sent to a sump and re-strengthened for a second application, or used as a preliminary wash on the next vat, and only passed through the precipitation boxes when showing no free acid. Under the circumstances in which the work was performed, it was considered economical to sacrifice acid and iron for other considerations.

The cement copper recovered was readily disposed of, although perhaps at a low price, since the total tonnage was small. Shipments averaged about 60% Cu, the balance being iron and silica.

STATEMENT OF WORKING FROM OCTOBER 1ST TO 16TH.

Date	No. of Vat, Acid.	% Acid.	% Cu.	Lb. Acid Required	Lb. Acid Applied.	Date Discharged.	% KCy Consumed	Date Loaded	Vat No., Cyanide	Assay Sands.		Date Discharged.	Assay Residues.		Recovery Per Ton.		Oz. Gold.	% Recovery	Notes.
Sept.						Sept.		Sept.		Dwt.	gr.	Oct.	Dwt.	gr.	Dwt.	gr.			
21	I	.54	.13	324	486	23	.06	..											
22	II	.64	.25	384	576	24	.05	..											
23	III	.58	.34	348	522	25	.04	25	I	9	17	1	1	17	8	0	30.00	82.4	A
24	I	.58	.37	348	522	26	.08	..											
25	II	.58	.32	348	450	27	.05	..											
26	III	.74	.40	444	666	28	.04	29	II	9	23	4	2	8	7	15	28.50	76.6	B
28	I	.70	.27	420	525	30	.07	..											
29	II	.64	.30	384	480	30	.04	..											
						Oct.		Oct.											
30	III	.70	.40	420	522	1	.05	1	I	8	14	8	1	14	7	0	26.25	81.0	C
Oct.																			
1	I	.43	.14	288	432	3	.08	..											
1	II	.89	.50	540	675	3	.11	..											
2	III	.84	.52	504	680	4	.06	4	III	9	20	12	1	15	8	5	30.75	83.9	D
3	I	.72	.40	432	540	6	.11	..											
3	II	.78	.40	468	585	6	.07	6	II	9	11	14	1	12	7	23	29.85	84.2	E
4	III	.58	.29	348	522	7	.09	..											
5	I	.66	.29	396	594	8	.09	..											
6	II	.32	.07	192	280	8	.13	8	I	7	15	16	1	16	5	23	22.35	78.7	F
..	..	.65	.32	6588	9057	..	.072	..	..	9	4	..	1	17	7	11	167.70	81.1	..

A.—Fair extraction. .25% average Cu, and .05% average KCy consumption. Six days' cyanide treatment.

B.—Poor extraction. Only five days' cyanide treatment.

C.—Fair extraction. .32% Cu. Seven days' cyanide treatment.

D and *E.*—Good extractions. .39% Cu. Only five acid vats were treated for the two cyanide vats, some acid treated material having accumulated. Eight days' cyanide treatment.

F.—Poor extractions due to slimes and imperfect acid treatment. Over .1% KCy consumption. Eight days' cyanide treatment.

From the 450 tons treated during this period, 1677. oz. of gold are theoretically shown as recovered. The actual recovery over a period of nine months was about 1% in excess.

The average value of the sands treated is shown as 9 dwt. 4 gr., of which 7 dwt. 11 gr. is recovered, leaving 1 dwt. 17 gr. in the residues, equal to an extraction of 81.1%.

The average theoretical strength of acid required per ton is shown as 0.65% H_2SO_4, equal to 165. lb., of 92% acid.

The theoretical quantity of acid called for is 6588 lb., a difference of 1 lb. per ton coming in on correction of tonnage treated.

The quantity actually consumed is 9057 lb. of 92% H_2SO_4, equal to 20.1 lb. per ton treated, or 4.5 lb.

No serious difficulty was found in getting a reasonable extraction of the gold from the acid-treated sands. The first experiment showed a possible extraction of only 65%, with six days' treatment, but this was found to be due to lack of aëration. While experimenting with various oxidizers it was discovered that sufficient aëration could be obtained by applying the solutions as before described. In practice the solutions were well circulated in the sumps, and the usual provision made of allowing the pump suction to draw a little air.

The working solutions seldom showed over 0.3% Cu, and usually were much lower. When, as latterly, more slimes had to be treated in the charges, conditions were not so favorable and more Cu had to be dealt with in the cyanide treatment. The zinc boxes then required careful attention, and the endeavor was to get as clean a precipitation of copper, as well as of gold, as was possible. Lead acetate was freely used and the boxes freshly made up at close intervals. No cyanide solutions were at any time discarded. When the solutions were foul they were always high in gold contents, and as the precipitation of the gold was accompanied by precipitation of the copper, re-aëration restored their working usefulness.

With frequently-fouling solutions it would probably have been economical to adopt the system of precipitation as suggested by H. A. Barker,* using HS_2O_4 to precipitate Cu in the sump, decanting off and recovering the liberated HCN by addition of caustic soda.

The product of the zinc boxes was extremely base, both from the Cu precipitated and the Pb employed to assist that precipitation. In the clean-up after solution and removal of Zn by H_2SO_4 and careful washing with distilled water, HNO_3 was used to remove Cu and Pb. This latter operation had to be performed with considerable care to avoid getting gold into solution.

All solutions employed in the clean up, including washes, were decanted into storage tanks and held until their values had been determined by assay. By using distilled water throughout and precipitating any chlorides with silver, no difficulty was experienced in producing bullion over 900 fine without loss. The ore itself carried very little silver.

Some experimental work was done on the separate treatment of the slimes in the heap of tailings. Naturally the acid process does not lend itself to any system of decantation for subsequent cyanide treatment. Filter pressing, involving special presses, and double treatment, would probably have given high extractions but was out of the question in view of the limited quantity of slimes available.

Among other experiments on the ore, it was noted that by a preliminary roasting the consumption of cyanide was reduced from 0.5% to .08%, but it was decided that, on account of the small tonnage available, the slimes could be most economically treated by judiciously working them in with the sands in the acid treatment by percolation.

The writer's thanks are due to Messrs. Nicholas & Nicols of Melbourne for permission to publish these details.

EXPERIMENTING WITH BLACK SANDS.

The last congress of the United States authorized the investigation of the black sands found in the placer mines of the United States; this investigation to be under the supervision of the director of the United States Geological Survey. Dr. David T. Day was given charge of the work, and a preliminary circular letter was sent to all the known placer miners of the United States, some 8000 in number. The circular was worded as follows:—

"Within the last few years much enquiry has been made concerning various minerals occurring in the heavy sands (so-called "black sands") which collect in the riffles in placer mining. The Geological Survey has therefore undertaken an exhaustive examination of all the minerals contained in the placer deposits of the United States.

"It is proposed to collect the heavy sands from all placer mines in the United States where evidence of platinum has been found by preliminary tests. The samples thus obtained will be used in determining the best methods of extracting the various minerals which have economic value. It is hoped that in many places the separation and sale of these useful minerals, such as magnetite, chromite, garnet, monazite, rutile, topaz, zircon, gold, platinum, iridosmine, etc., will become a permanent and profitable industry.

"As a preliminary step in this investigation you are cordially invited to mail to this office, not more than 4 pounds of material most likely to contain platinum in your placer deposit. This material will be carefully examined, and you will be duly notified of the results. It is suggested that you concentrate the gravel as well as you can before mailing it, care being taken not to lose any heavy material. You should carefully note on the package, or in a letter accompanying it, or both, the total quantity of original gravel which your concentrate represents, in order that a general idea may be obtained of the value of your gravel for the purposes under investigation.

"After an examination of these preliminary samples, experts will be sent to all localities where preliminary tests give promise of any useful mineral in profitable quantity. The expert will report on the size of the deposit and superintend the collection of representative samples for concentration.

"Concentration experiments will probably be carried out in connection with the exhibits of mining machinery at the Lewis and Clark Centennial at Portland, Oreg., between June 1 and October 15 of this year.

"I shall appreciate all information which you can give as to any efforts previously made to separate platinum from your sand, or from other sands in your neighborhood, and as to the quantity of platinum produced in your district. Each package of sand should be accompanied by exact information as to the name and post-office address of the sender, the name of the mine or claim from which it came, and the State, county, city, village, or district in which the deposit is located.

"On account of the increased demand for platinum, it is the intention of this office to examine also the localities where experience has made it probable that platinum ores may profitably be looked for in place. The inclosed tags can therefore be used also for sending in specimens of ores likely to contain platinum and associated metals.

"Great care should be used to pack the sand securely for transmission through the mails. It is preferable to sew up the sandtightly in a canvas bag and tie the tag, which requires no postage, carefully to the package. The sand should be dry when mailed.

"On request, additional postal franks will be sent to you.

"No specimens will be examined unless the above information in regard to the exact locality from which the samples have been obtained.

"The accompanying information in regard to platinum may be of interest to prospectors:

PROPERTIES OF PLATINUM.

"Pure platinum is a silvery white metal with a specific gravity of 21.5. It is the heaviest metal occurring in nature with the exception of iridosmium. It is almost as hard as iron and very malleable. Platinum does not amalgamate with quicksilver, is not dissolved by potassium cyanide when cold, and is not attacked by acids, except the mixture of nitric acid and hydrochloric acid known as aqua regia. It is more difficult to melt than gold.

"Native platinum has been found most frequently in gold-bearing sands. On account of its weight it remains in the sluices with gold and other heavy material.

"Platinum is most readily distinguished as follows: (1) By its great weight—in panning it remains behind even gold in the pan; (2) its white color—it is whiter than lead and is distinguished from amalgam by its smooth surface, whereas the surface of amalgam, as seen under a good glass, is rough; (3) its resistance to nitric acid, as compared with native silver or lead.

"Native platinum is usually very impure; occasionally it contains so much iron, chromite, and other impurities as to be dark in color and not easily distinguished from grains of chromite with which it is very frequently associated. It often contains iridosmine, which occurs as flat angular scales, while platinum grains are usually rounded like gold dust. Generally, platinum grains are smaller than gold grains. Large nuggets are very rare."

In response to the request 828 samples of black sand were sent in for investigation, up to the time the report we are quoting from was issued. These samples came from 32 states and territories, as well as from Central America, Cuba and British Columbia. The responses showed that there has been more interest taken in these matters than has been heretofore supposed.

* *Trans.*, vol. xii, pp. 399-401.

Of the samples received 195 specimens were assayed for their gold and platinum contents. The value in gold ran from a trace to 191.60 ounces in gold, and the values in platinum from a trace to 128.73 ounces per ton. One hundred and ninety of these samples were also examined for the minerals that they contained in addition to gold platinum: columbite, tantalite, magnetite, ilmenite, epidote, zircon, topaz, scheelite, hematite, pyrite, garnet, diorite, tourmaline, manazite, apatite, molybdenite, cinnabar, copper, actinolite, biotite, tremolite, psilomelane, rutile and polycrase. During June and July of last year investigations of various placer deposits were carried on. A preliminary examination of the heavy sands at the mouth of the Columbia River and from the Washington shore line was made by Dr. Day. He also examined the sands pumped up from the bottom of the Columbia River at Pillar Rock by the United States engineer. All these were sent to a concentrating pavillion, that had been built at Portland, where the practical tests were to be carried out. In addition to these sands he examined numerous samples from placer mines on the Pacific slope, as well as other beach sands from as far south as Sandiago.

RESULTS.

The following results have been obtained by concentrating the black sand:

Forty pounds of black sand received from Placer, Josephine County, Oreg., yielded oversize on 10-mesh screen, 18 pounds, 9 ounces, which yielded 13.754 grams of gold nuggets. The undersize, through a 10-mesh screen, weighing 21 pounds,5 ounces, yielded 11.6 grams of nugget gold. The total weight, 25.354 grams, would be worth, if pure, $16.84, giving a value per ton of $842.

Another interesting run of the black sands was from the residue from a clean up of dredging operations from Rockpoint, Oreg., which weighed 468.6 pounds, and contained quicksilver, amalgam, and gold. The oversize, through 10-mesh screen, was 223½ pounds and yielded 3.992 grams of gold; the undersize was 243 pounds and gave 15.270 grams of gold, making a total yield of nugget gold of 19.262 grams. This, if pure, would be worth $12.71, or the residues were worth $54.20 per ton.

Sea sand taken from near Fort Stevens, Oreg., at the mouth of the Columbia River, yielded the following results in pounds per ton of 2,000 pounds, on one of the concentrating tables, supplemented by the magnetic machine and by panning the samples:

[Pounds per short ton.]

Mineral obtained.	In the lot fed.	In the No. 1. concentrate	In the No. 2 concentrate	In the tailings.
Magnetite..........	683.0	572.0	44.6	66.79
Chromite and ilmenite *a*. .	163.0	150 0	9.44	3.06
Garnet..............	227.0	61.5	29.6	135.5
Monazite.............	.85	.36	.42	.07
Zircon...............	5.32	4.91	.01	0.40
Quartz...............	288.0	.97	2.86	284.3
Other minerals *b*........	483.0	5.71	5.71	471.7
Gold and platinum*c*.....	....	....	....	....

a This product may prove by analysis to be mainly ilmenite.

b This product includes all the minerals that could not be separated into distinct groups.

c A satisfactory figure for publication has not yet been obtained.

THE MAGIC LURE.

For generations the great hinterland, back of the St. Lawrence, has lain fallow. With so much agricultural land to choose from it was quite natural that the young men of the Dominion should stake out for themselves farms in more genial and accessible regions. Yet, we must not forget that competent observers have found a large amount of excellent land in Northern Ontario, and a certain quantity of it in Northern Quebec, and it is more than probable that the recent rich finds of mineral in Cobalt, Chibogamoo, and elsewhere, will result in increased attention to these northern lands; and we know that history repeats itself. In 1851, after 63 years of colonization, the population of Australia was 403,000. In '51 gold was discovered. The whole face of Australia became changed, and in ten years the population had grown to 1,154,000. Similar effects were witnessed in California, in fact, have been noted wherever valuable mineral discoveries have been made. We may look forward with some confidence to a large increase of population in Northern Quebec and Ontario, and such increase will, it seems probable, occur within the next five years.

GERMANS USE MORE COPPER.

The following are the figures of the German consumption of foreign copper during January 1906, as compared with the corresponding period of 1905:—

	1906	1905
Imports..........................	10,333 tons.	7,500 tons.
Exports..........................	1,099 tons.	926 tons.
Consumption......................	9,234 tons.	6,574 tons.

Out of the above, 7586 tons were imported from the United States.

MINING IN BRITISH COLUMBIA.

The Annual Report of the Minister of Mines of the Province of British Columbia, for the year ending December 31st 1905, has been issued. As usual, this report is a model that could be followed with advantage by some of the other provinces. There can be no possible harm in making a report attractive, in fact we are inclined to think it wise so to do, and the British Columbia report is always a work that is not only attractive to the mining man, but of considerable interest to the laity as well. It is embellished with several pleasing reproductions, in colours, of British Columbia scenery, and though these cannot be considered as strictly germane to the subject of the publication, we think that it was wise to include them. They are, certainly, a means of advertising far and wide the beauties of Canada's most beautiful province.

The Provincial Mineralogist, Mr. William Fleet Robertson, in his report to the Minister of Mines states:

"The gross value of the mineral production of the Province during the year 1905 was $22,461,325, the largest output ever made by the mines of the Province, and an increase over the preceding year of $3,483,966, or 18.4%, while it is an increase over the year 1903 of over 28%. An analysis of the returns shows, however, that this increase has been confined to certain districts, South-East Kootenay, the boundary District, Nelson Mining Division, and Yale Mining Division, the remaining districts showing a more or less marked decrease. The greater part of the increase is in the two former of these districts. In South-East Kootenay the tonnage of ore mined increased 121% and the value of the product 135% over the preceding year, while in the Boundary the tonnage has increased 20% and the value of the output 53.6%.

The Slocan District shows the most marked decrease this year, its output being little better than half of what it was in the preceding year.

The Rossland camp just about held its own this past year. The tonnage of ore mined increased about 5%, but the values per ton diminished somewhat on the average, owing to the working of low grade ores by concentration methods.

The tonnage of ore mined in the whole Province, exclusive of coal, was this past year 1,706,679 tons, some 245,070 tons, or 16% greater than in 1904, and 85% greater than was mined 1901.

The number of mines from which shipments of ore were made in 1905 was 146, and of these only 79 properties shipped over 100 tons during the year, practically no change from the preceding year. Some 38 mines each shipped in excess of 1,000 tons, of which seven were in the Nelson Division, four in the Slocan, seven in Trail (Rossland,) and eleven in the Boundary.

The following table shows the number of metalliferous mines which shipped ore during the past year, together with the location of these mines and the number of men employed both above and below ground:—

remedying by bringing in water from another water-shed to supplement the present supply, at the expenditure of a large amount of money.

In the Fraser River District the dry season did not have so much effect, but individual mining on the bars appears to have been replaced by dredging, and the dredges have not met the expectation of the operators, for the reason, it is claimed, that the dredges have proved to be of too weak construction, and were so constantly under repair as to reduce the actual working time below the margin of profit. Steam shovels have not, as yet, been fully proven, and the one formerly operated in South East Kootenay has been, at least temporarily ,abandoned. The Atlin shovel apparently worked very well, but the appliances for handling the tailings and for washing the gravel proved quite inadequate, so much so that the capacity

TABLE SHOWING DISTRIBUTION OF SHIPPING MINES IN 1905.

	Tons of ore shipped	No. of mines shipping	No. of mines shipping over 100 tons in 1905	Men employed in these mines		
				Below	Above	Total
Cassiar:						
Skeena	143	2	1	8	11	19
East Kootenay:						
Fort Steele	170,073	3	3	250	67	317
Windmere	226	6	0	31	13	44
West Kootenay:						
Ainsworth	3,331	13	7	67	39	106
Nelson	50,090	21	15	250	142	392
Slocan	88,279	52	20	352	105	457
Trail	330,618	8	8	582	251	833
Other Divisions	22,302	8	3	89	26	115
Lillooet	133	1	1	2	2	4
Yale:						
Boundary	965,628	20	16	595	421	1,016
Ashcroft-Kamloops	1 4,642	3	1	52	25	77
Similkameen-Vernon	88	1	0	7	7	14
Coast	61,126	8	4	109	93	202
Total	1,706,679	146	79	2,394	1,202	3,596

The collieries actually producing coal in the Province during 1905 were the same as in previous years, and are situated either on the Eastern side of Vancouver Island or on the Western slope of the Rockies, near the Crow's Nest Pass in the southeastern portion of British Columbia. The Vancouver Island collieries are operated by two companies, the Western Fuel Company, at Nanaimo, and the Wellington Colliery, at Ladysmith, Comox, while the collieries in Southeast Kootenay, at present some three in number, at Michel, Fernie and Carbonado, are all owned and operated by the same company—the Crow's Nest Pass Coal Company. The gross output of the coal mines for the year was 1,825,832 tons (2240 lbs.), which, with 314 tons taken from stock, makes a total production of 1,826,146 tons. Of this total amount 1,202,971 tons were sold as coal, 441,520 tons were used in making coke, and 181,655 tons were consumed under the company's boilers and sold locally. The coke produced amounted to 271,785 tons, of which some 268,091 tons were sold and 3,694 tons were added to stock.

The production of placer gold during the year amounted to $969,300.00, a decrease of $146,000.00, or 13% as compared with that of 1904, and is therefore the smallest output made in any year since 1901. This falling off is attributable to a very dry summer, preceded by a winter with little snow, with a resulting decreased supply of water for hydraulicing, in which class of mining the output seems to be in direct proportion to the water available for use, since the deposits of gravel appear to be fairly regular in their tenure of gold, and the output is measured by the amount of gravel washed. In the Atlin District the output of this past year was about $475,000.00, considerably less than in 1904, but still in excess of any year previous to that. In this district the drought was not so severely felt, as about 40% of the gold is mined by "individual" methods, in which case a large amount of water is not necessary. In the Dease Lake section of Cassiar mining is carried on largely by hydraulic methods, and between the dryness of the weather and the obstacles presented in getting plant in over a long pack trail, the season was not successful. The Cariboo mining division of the Cariboo District about held its own, but the production of the Quesnel Division was some 40% less, owing to the very short run made by the largest producing property. The Consolidated Cariboo, due to an unprecedentedly low water supply, a trouble which the company has set about

of the shovel was never fully demonstrated. Enough was learned, however, to indicate that, for conditions in the North, the steam shovel is likely to prove much more effective than the dredge.

The value of the output of gold in British Columbia from lode mining for the year 1905 was $493,102.00, an increase over the preceding year of some $343,494.00, or about 7½%, due entirely to the increased tonnage of gold-bearing copper ores smelted in the Boundary District. The greater part of the lode gold produced is found in combination with copper; in fact only 11% of the total gold is produced from stamp mills, and even in these mills about half of the values are obtained in concentrates, which are afterwards smelted.

About 70% of the silver produced in the Province was associated with lead and argentiferous galena, the remainder being found chiefly in conjunction with copper ores. The total production was 3,439,417 ounces, valued at $1,971,818.00, the largest output the Province has made since 1901, despite the fact of a decrease in the Slocan of 494,000 ounces. The increase is due, primarily, to the extensive working this year of the galenas, low grade in silver of the Fort Steele District, which district shows an increased production of nearly 550,000 ounces; and, consequently, in the increased tonnage of the large copper mines in the Boundary, and the working of certain smaller but high grade properties in that district, resulting in an increased silver production in the Boundary of about 385,000 ounces.

(*To be Continued.*)

MINING IN QUEBEC.

The report of the Department of Colonization of Mines and Fisheries of the Province of Quebec, for the year 1905, has just been issued. Mr. J. Obalski, Superintendent of Mines, states that the production exceeded that of 1904 by about one million dollars. The discoveries at Chibogamoo and Cobalt have greatly encouraged prospectors, and numerous applications for prospecting licenses in the Northern districts of the Province between Lake Temiskaming and Lake Mistassini are being received.

Mr. Obalski spent some time at the Liège Exhibition as commissioner for the Dominion Government, and was active in making Canada's mineral wealth known in Europe.

IRON.

There has been no development in our iron mines with the exception of prospects and experiments in connection with the magnetic sands of the north shore of the St. Lawrence. It may, however, be stated that, according to borings beneath low-tide level, those sand deposits extend in certain cases some distance out and could be dredged where the water is shallow.

Experiments in the treatment of iron ores in electric furnaces are being continued at Sault Ste. Marie under the patronage of the Federal Government but we must await a final report to know whether that process has really any commercial value.

COPPER.

The Nichols and Eustis Companies continued to work regularly. The latter put up concentration works to utilize the large quantity of debris that had accumulated for some years.

The Ascot Mine was lightly worked, producing a small quantity of good grade ore, which was treated at Capelton. The King Mine on lot 4, II Ascot, was sunk deeper, a few men being employed throughout the year, but no ore was shipped.

This year's yield for the whole region was 25,575 long tons, of the value of $128,850, 14,172 tons of which were shipped to the United States, and the remainder treated for sulphur and copper by the Nichols Chemical Company at Capelton; 245 men were employed during the greater portion of the year.

ASBESTOS.

The asbestos industry has continued to develop with the greatest success, and this year the production was 25 per cent. greater than last year while the prices have kept up. The new uses made of asbestos pulp are very encouraging and most remarkable imitations of wood are now seen which seem likely to have a good future. The result of the progress has been the opening of new mines, which, until the present, have been considered as under less favorable conditions than the mines formerly worked. At Thetford, the Bell and King companies (the latter now being the American Asbestos Company), and the Johnston Company worked both mines and mills throughout the year with the greatest activity and the maximum of production.

It is proposed to introduce electricity as motive power in the mines and mills, the St. Francis Water-Power Company being prepared to supply it.

Discoveries made last year at Chibogamoo have been confirmed, but that region cannot put its productions on the market until a railway is built. Activity in the asbestos industry has also called attention to indications found in Gaspesia and in the Temiskaming region, but nothing has yet been done there.

The production of asbestos during the year 1905, in tons of 2000 lbs. was:

1st. class crude	1340 tons	worth	$221,325
2nd " "	2258 "	"	243,785
Fibre	10707 "	"	386,440
Paper stock	34655 "	"	624,900
Total	48960 "	"	$1,476,450
Asbestic	19220 "	"	31,100

One thousand six hundred and fifty workmen, receiving $580,000.00 in wages, were employed during periods of from seven to twelve months. Seven companies produced regularly and actively, two of them working mines and mills at Thetford and Black Lake at the same time.

The production for last year (1904), not including asbestic, was 35,479 tons worth $1,186,795, thus making an increase of 25 per cent for this year as already stated.

MICA.

Mining for amber mica was continued in the county of Ottawa, there being no change in the number of companies shipping.

The market for amber mica is fairly good, especially for small dimensions, and Ottawa continues to be the centre of preparation for mica from the Ontario and Quebec mines. The mining companies themselves prepare the mica from their mines at Ottawa and Hull, but the following companies must also be mentioned: The General Electric Company, the Laurentides Mica Company, E. Munsell and others of less importance, which have thoroughly fitted up works where the mica is trimmed and split or even cut in special shapes for shipment to the United States where it is transformed into micanite or other commercial products. The works are provided with knives and tools, driven by steam or electricity, and women are employed, as their labor is most suitable for such delicate work. This industry gives employment to 600 women and girls at Hull and at Ottawa; they are under the supervision of forewomen and work by piece-work, earning very fair wages.

A noteworthy fact is that mica is beginning to be shipped regularly to Europe and our amber mica is highly appreciated owing to its flexibility and its being easy to split.

While I was at the Liége Exhibition, we received many applications which were referred to the Canadian producers, and I think that, when an understanding shall have been come to with reference to the merchantable form of that mica, a good market will be found for it in Europe. It is true, on the other hand, that we have to compete with the Indian mica which can be delivered at a very low price owing to the cheapness of labor in that country, and it is a noteworthy fact that the companies mentioned above, which prepare mica at Ottawa, receive large quantities of Indian mica of small dimensions, very well prepared, which is split and mixed with Canadian mica for the manufacture of micanite. Those companies assert that it does not cost them more, delivered in Ottawa, than the mica of our own country.

The production in 1905, representing the quantities shipped, is as follows:

½	65666 lbs.	worth	$ 3852
⅓	159562 "	"	22316
⅔	63206 "	"	23165
2-4	45170 "	"	21730
3-5	16332 "	"	11012
4-6	6358 "	"	6190
5-8	857 "	"	786
Total thumb-trimmed	357160 "	"	$89060
Split	21400 "	"	6400
Total	378560 "	"	$95460

WHITE MICA AND RARE EARTHS.

Several mines of white mica (muscovite) are likely to be worked after having been abandoned for several years. As it has been found that this white mica carries Uranium, Thorium, Yttrium, Cerium, and also, in some cases, Radium. A French Company proposes to work the Maisonneuve mine, in the County of Charlevoix, for these rare minerals. Last season several tons were sent from this mine to Paris, to be assayed, and the results were evidently satisfactory.

PHOSPHATE.

Very little phosphate was mined last year, the total reaching but 1,475 tons, valued at $18,875.00. This phosphate came from Ottawa, and partly from mica mines, though a little was got from old phosphate mines.

BUILDING MATERIALS.

The International Portland Cement Company, Ltd., of Hull, and Mr. T. M. Morgan's plant at Longue Pointe, Montreal, produced altogether 254,833 barrels worth $408,000.00. It is anticipated that this industry will increase very rapidly. The following summary shows the total wealth of the mines in the Province of Quebec for the year 1905:

Kind of Minerals (Tons of 2,000 lbs.)	Wages paid.	Number of workmen.	Quantities shipped or used.	Gross value.
Bog iron ore	$ 22,000	120	12,373	$ 35,268
Chromic iron	52,000	125	8,528	104,565
Copper ore	90,928	245	28,644	128,850
Asbestos	576,700	1,650	48,960	1,476,450
Asbestic	....	....	19,220	31,100
Mica (pounds)	45,000	180	378,560	95,460
Calcined ochre	11,035	56	1,905	22,675
Phosphate	....	....	1,475	8,875
Slates (squares)	15,000	45	4,900	21,568
Flag-stones (sq.yds)	1,700	6	2,930	2,490
Cement (barrels)	150,000	160	254,833	408,000
Granite	70,000	180	....	120,000
Lime (bushels)	....	350	1 million.	140,000
Bricks	600,000	1,200	120 "	625,000
Stone	....	700	....	530,000
Totals	$1,634,363	5,017	....	$3,750,300

PERSONALS.

Mr. T. Hayes Sheen, a director of the Copper Mining & Smelting Company of Ontario, is visiting the Bruce mines.

Mr. A. R. Wilson, superintendent of the colliery at Michel, Crow's Nest, has gone to his ranch in the Okanagon for a holiday.

Mr. A. G. Browning, Crown Attorney of North Bay, has been in Cobalt looking after some cases he has on hand pertaining to the stealing of ore from the mines.

Mr. Cecil B. Smith, chairman of the Temiskaming & Northern Railway Commission, visited Cobalt a few days ago in order to ascertain the needs of the place.

Mr. J. B. Tyrrell, C.E. and M.E., has been engaged as mining expert by Mackenzie & Mann, of the Canadian Northern Railway, and will have his headquarters in Toronto.

Superintendent A. B. W. Hodges, of the Granby mines and smelter, has been visiting the Crow's Nest Pass and making a careful investigation of the various coking coals of that region.

Mr. J. H. Black, Superintendent of the Temiskaming & Northern Ontario Railway, was in Cobalt recently looking over the place and making final arrangements for the sale of town lots.

Mr. Arthur Harris, mining engineer of London, England, has arrived in Cobalt and will make a thorough examination of the mining section of the district and report to the members of the syndicate which he represents.

Mr. W. F. Ferrier, formerly geologist for the War Eagle and Centre Star mines, but now a resident of San Francisco, has been heard from. He went through the disaster safely. Mrs. Ferrier and her two children are in Toronto.

Mr. M. M. Johnson, Consulting Engineer of the Dominion Copper Company, has returned to his home at Salt Lake City, Utah, after a visit to Phœnix, where he has been consulting with Mr. Thos. R. Drummond, Manager for the Dominion Copper Company.

Mr. Fuller C. Smith, chairman of the Vermont State railway commission, of St. Albans, Vt., and Colonel H. S. Bingham, one of the commissioners and secretary of the commission, of Bennington, Vt., were in Rossland recently, and visited the workings of the Le Roi.

Mr. F. A. Paulin, late Chicago Manager, for the India Rubber Company of New Brunswick, N.J., is now in charge of the Tire Department of The Canadian Rubber Co. of Montreal, Limited. Mr. Paulin is a Canadian by birth, having spent his early years in the Carriage Trade in Ontario. He has had extended experience during the past twelve years throughout the larger cities in the United States.

Mr. Richard Russell, of Hamilton, Ont., was in Penticton recently attending the meeting of the Southern Okanagan Land Company. Mr. Russell is one of the heavy stockholders in the once famous Stemwinder, Fairview. He states that, after having spent one million dollars, capital is again available, and another half million will be spent in further work upon the Stemwinder.

Mr. K. Nakamura, chief metallurgist of the Besshi Copper mine, Island of Shikoku, southwest of Kobe, Japan, has been visiting the Granby, Nelson, and Hall Mine Smelters. He is now in the United States, and later on will go to Mexico and Europe. He will probably visit South Africa and Australia before returning to his country. He is one of the most eminent of Japan's metallurgists.

Mr. Jacob Langeloth, of New York, the president of the Granby Consolidated, has been visiting Phœnix on his annual trip of inspection. Mr. Frederick Keffer, M.E., chief engineer of the British Columbia Copper Company, accompanied by Mr. Johnson, formerly superintendent of the Emma mine, who has been examining the Gloucester group, recently acquired by the B.C. Copper Company.

Mr. A. L. Mudge, who has been appointed Estimating Engineer of Allis-Chalmers-Bullock, Limited, Montreal, is one more Canadian who after experience in the great industrial establishments of the United States, has returned to take a responsible position at home.

After graduating from McGill University in Mechanical Engineering in 1894, and in Electrical Engineering in 1895, he spent one and one-half years with the Canadian General Electric Co., Peterboro, and afterwards some time with the Royal Electric Co., Montreal. From 1899 to 1901 he was Electrical Engineer for the Grand Trunk Railway System from Portland to Detroit. From Montreal he went to Pittsfield, Mass., to take charge of construction work for the Stanley Electric Manufacturing Co. During the past two years he has been with the Allis-Chalmers Co. partly in the Bullock Electric Works, Cincinnati, and latterly in the Head Office, Milwaukee.

MINING NOTES.

BRITISH COLUMBIA.

The St. Eugene's output for the month of April was 2,860 tons.

The Bottom Dollar and Nancy Hanks are said to be showing up well in development.

The Velvet Portland mine, after having been shut down for more than a year, is to be opened again. Mr. Paul S. Couldrey, manager of the Le Roi No. 2, will be in charge.

The Canadian Pacific is building a new depot at Fernie, together with freight buildings. Work will be completed as rapidly as possible.

Ore has been found on the Jumbo, 150 feet from the Old Glory hole. The new find is on the foot instead of the hanging wall. The ledge at this point is about 300 feet wide.

A winze is being sunk from the fifth level of the Ottawa. A new hoist and 10-drill plant of the Lidgerwood make is being installed.

The Consolidated Mining and Smelting Company of Canada has just secured a controlling interest in the Eureka Copper Mines on Forty-Nine Creek.

The Telkwa Mining, Milling & Development Company owning extensive properties near the headquarters of the Telkwa and Copper Rivers, has sent up a number of men to the Bulkley Valley, in charge of Mr. Harry Howson, general manager.

The Ore Hill mine at Salmo has ordered from Chicago a three rapid-stamp outfit, and this, with what mill machinery they now have will give them a five-stamp equipment. They are also erecting a 750-foot tram from the mine to the mill.

The returns for the Tyee smelter at Ladysmith for the month of April show that the smelter ran 13 days and treated 1,717 tons of Tyee ore, giving a return, after deduction of freight and refining charges, of $34,723.

Wilson Creek, a tributary of O'Donnell River, is the scene of the most recent stampede. Pay has been found in hard pan two feet below the surface. The new discovery is about 26 miles from Atlin. For several miles on the south side of Discovery, the creek bottom is from one to two hundred feet wide, but with little grade. There is said to be ample water.

A discovery of free gold is said to have been made on Woodbury Creek, near Nelson, B.C. The finders have blanketed the country with claims, recorded at the Ainsworth office. It is claimed the discoveries are equal to anything ever found on Poplar Creek. Woodbury Creek is situated on Kootenay Lake, discharging into it north of Proctor and south of Kaslo.

Operations on the development of the Bog iron ore properties, on the southwest arm of Quatsimo, V.I., are vigorously being carried out. The ore is looking better all the time. The management has just decided to supplant all its Chinese hands with white labor, a move which will be greatly appreciated by the settlers in that locality.

The Ymir Gold Mines, Limited, having followed a policy of development since last fall, will shortly resume operations on a larger scale. The development work that has been done has proved conclusively that the contention of manager E. M. Hand, supported by Mr. Gilman Brown, the company's consulting engineer, was absolutely correct. Mr. Hand came to the conclusion shortly after he took control that the future of the mine depended upon the western half. In working there he found a large ore body at depth. That ore body has now been well opened up and shows good values and great extent from the 700 foot to the 1000 foot level.

The larger mines of the camp, the Centre Star, War Eagle, Le Roi and Le Roi No. 2, have been very successful in locating the ore bodies by means of diamond drills, indeed, it is now considered a necessary part of the equipment of each of these mines to have diamond drills which are kept in constant operation. It is found to be the most economical method of prospecting. Encouraged by the success of the diamond drills in the larger mines, they are now being adopted in the smaller. The Jumbo and White Bear are now arranging for some extended experimental work with the diamond drills. In the latter operations will be commenced with the drills on Monday and in the former in a few days.

Boundary District.

Two diamond drills are again being operated at the Granby mines.

Some Providence ore is being sent to the Hall Mines smelter at Nelson.

A diamond drill is being operated at the McKinley mine, McKinley camp.

A glory hole is being opened up on the Stemwinder, and the Idaho is likely to have another.

A 12-inch gold and silver vein has been opened up on the Starve Out claim, near the Helen, by Hostetter and Peone.

Smith & Co., of Grand Forks, are reported to have taken up the bond acquired by them on the M. S. group in Franklin camp.

In sinking to the 300-foot level of the Elkhorn, about eight inches of excellent silver ore were found a few days since at a depth of 260 feet in the shaft.

A cross-cut is being run from the 100-foot level on the Washington and Idaho, West Fork, where Mike Callaghan has half a dozen men at work for Collins Hunter and others.

Development work is to be resumed on the Bay mine in Skylark camp, which has produced such high values in gold in the past. The boiler is being repaired, and active work will be taken up again.

From the last car of Rambler ore net returns of $111 per ton were received, the property being located up the West Fork. It is reported that the owners refused a bond of $50,000 on the Rambler quite recently.

Pay day in the Boundary camps means the disbursing of $125,000.00. This does not include the pay roll for the work being done on new construction. The different companies paid out in April as follows:—Granby, $75,000.00; B. C. Copper Company, $26,000.00; Dominion Copper Company, $25,000.00.

The Rathmullen mines, in Summit camp, are steadily progressing and will have one of their group a shipper shortly. Considerable development work has been done the past two years on the crown granted claims of the company, but latterly work has been confined to the Reliance claim, which has been developed by a 100-foot shaft and drifts at the 50-foot and lower levels. The face of the drift at the 100-foot level is well in ore.

The four-compartment shaft at the Mother Lode mine is nearing the 400-foot level. Drifting to connect with the winze from the north drift, which reached the 400-foot level some time ago, will be done as soon as possible after the shaft reaches the 400. The Mother Lode diamond drill has been in operation on Primrose ground (to the south of the main shaft), where a hole 200 feet deep has been drilled, showing considerable ore.

Mr. M. M. Johnson, consulting engineer to the Dominion Copper Company, with Mr. Thos. R. Drummond, manager, inspected the Sunset group, in Deadwood Camp, the Mountain Rose in Summit, and the Brooklyn Stemwinder, Idaho, and Rawhide mines in Phœnix Camp. He also visited the company's reduction works at Boundary Falls. In the course of the present month active work will be under way on some of the improvements, which include preparations for doubling the smelting capacity to 1,200 tons daily and the installation of a new 25-drill electric-drive air compressor at the Idaho mine in Phœnix camp. Some time in early fall, if machinery contracts are lived up to, these improvements should be completed, and in the meantime the mines of the company are being placed in a position to furnish the increased output needed to keep the enlarged smelter busy. At mines and smelter the company is now employing 300 men, and the smelter is turning out about a carload of copper matte every other day.

The Canadian Rand Drill Co., of Sherbrooke, Que., has received an order for an electric air-compressing plant for the Brooklyn group in Phœnix Camp, B. C. It will be of the double compound tandem type, similar to that in use at the Granby mines, but smaller, having a rated capacity of about 25 machine drills. This compressor will be capable of furnishing 2,726 cubic feet of free air per minute at sea level, or about 2,300 feet at the level of Phœnix. Delivery of the new plant has been contracted for in sixty days' time.

The contract for the 400 h.p. electric motor, to drive the new compressor has not yet been awarded, but probably will be within the next few days.

For a hoist for the three-compartment shaft being sunk on the Idaho mine, the steam driven hoist now in use by the company at the Sunset mine, Deadwood camp, will be altered for electric service and transferred to this camp. This is a large machine and suitable for the work intended. A contract for the 150 h.p. electric motor, to drive this hoist, has been awarded to the Allis-Chalmers-Bullock, Ltd., of Montreal, and will be rated at 550 volts. The motors will have full equipment of transformers, etc.

This machinery is all intended for a centrally located plant, to serve the Brooklyn, Stemwinder and Idaho mines in the heart of this camp, and as soon as needed, work will be started on the large buildings needed to house the new machinery.

YUKON.

A nugget, weighing 9½ ounces, has been taken out of No. 21 Below, on Sulphur Creek, Klondike. The shaft had been abandoned, yet this is the largest nugget ever taken out of the creek.

An important feature on the Yukon this summer will be the active development of the coal mines at Tantalus, midway between Whitehorse and Dawson, says a recent number of the *Vancouver World*. The mine was recently purchased by the White Pass & Yukon Route Co.

It is said Dr. David Y. Day of the U.S. Geological Survey has found sufficient platinum in sand from the Hootalinqua to make it worth while dredging that stream. A Portland company has been formed to work the leases acquired by the Rev. Mr. Vrooman of that city.

A quest for gold in Terra del Fuego, south of Patagonia, is the object of an expedition which will shortly start from Great Britain.

Prospectors discovered alluvial gold as far back as 1880, and the purpose of the present expedition is to dredge for gold, in that country.

A stern-wheel boat has been constructed in Thornycroft's yard at Chiswick on the Thames, for the use of the expedition.

"Mine and Quarry" is the name of a quarterly bulletin issued by the Sullivan Machinery Company. Its object is to familiarize its readers with the different classes of machinery manufactured by the Sullivan Machinery Company. It is published at the Railway Exchange Building, Chicago. The initial number contains a very interesting paper on the cleaving of granite by compressed air, together with several other articles that will prove of interest to mining engineers and others whose work is connected with the mining industry.

The Ballarat Company, organized under an Ontario charter, is to dredge the Fortymile this summer. The original ground secured by the Company was that known as the Rutledge concession, but later all the interests from the mouth of the Fortymile to the international boundary were consolidated, and a Dominion charter obtained. There is another dredging company on the American side which is often confused in reports with that controlled by the Davidson Brothers and the Rev. Dr. Grant, who are the largest shareholders in the Ballarat. The dredge recently bought from the Treadgold people was sledded over the ice for use on the American side from Bonanza to Fortymile.

QUEBEC.

The Diamond Graphite Co., of New York commenced the erection on Mr. James Cosgrove's property at Buckingham, P.Q., of a hundred ton ore treating plant with offices, boarding houses and other accessories of a large centre of mining and milling operations. Mr. Geo. N. Brewer, the energetic manager of this company, now that arrangements have been completed for the transfer of many valuable properties to his company has a gang of men at work in building operations according to plans prepared by himself during negotiations between the Diamond Graphite Co., and some residents by the satisfactory conclusion of which the company acquired sufficient ore bearing ground to run the proposed plant indefinitely. Work on the plant will be pushed as strongly as possible. Between thirty and fifty men are employed and this number will be increased very soon. It is proposed to run the plant by electricity, but whether it will be generated at the mine or brought from a distance has not been decided yet.

ONTARIO.

The International Nickel Co. has sent an expert to report on the mineral lands of the Anglo-American Co. in Eastern Ontario.

Machinery for dressing has been installed at the sodalite mine near Bancroft. The demand for this stone for decorative purposes is growing as it becomes better known.

Hon. F. Cochrane has not yet given his decision in the dispute as to the ownership of the Josephine iron mine as it is hoped the parties concerned may be able to arrive at a settlement.

A valuable find of bog iron ore is reported from the township of Oakley, Muskoka. The ore is said to be almost entirely free from sulphur. It has been tested at a Bracebridge foundry and gives every satisfaction.

A quartz reef has been discovered on the farm of David Todd, three miles from the Oso railway station. The reef is three feet six inches in width, and assaying one ounce of gold per ton. Developing work is to be proceeded with.

A smelter plant has been set up at the El Dorado copper mine in Hastings and will be in operation in June. A stamp mill and tubular boiler have been ordered. Recent tests with the diamond drill show satisfactory results.

A suit for $5000 damages has been brought by the Dominion Improvement & Development Co., of Westport. Leeds Co., against John Blackhall of Lanark Co. and Chas. E. Eisner, of New York, for trespass on a mica mine which the plaintiffs' claim to own.

An order for 650 tons of talc from the Madoc Mine has been received from New York. A mill is to be installed to grind the mineral on the spot for the Canadian market. Hitherto it has gone to the United States to be ground and then returned to Canada.

Among the mining leases cancelled during the past month for non-payment of dues are a number in the older parts of Ontario, including Muskoka, Lennox and Addington, Hastings, Haliburton, Renfrew and Peterborough. Those cancelled hitherto were in New Ontario.

Prof. Geo. R. Mickle, lecturer on mining at the school of Practical Science, Toronto, who was one of the inspectors in the Cobalt district last year, has been appointed, under the Mines Act of last session. inspector of mining claims for the present season, and has entered upon his duties.

Some fine crystals of mica have been taken from the Smith mine, in Burgess, Ontario. One crystal sold for $30.00. One cut taken out of it measured 22 + 14 inches. About $200.00 worth of mica a day has been mined. The mine owned by William McLaren is turning out mica to the value of about $300.00 each month.

The Atlas Arsenic Co. is proposing to work the mispickel ore on the Gatling property in Marmora. This ore contains about 46 per cent of arsenic and at present prices should be worth working. It carries also about $7 a ton in gold. The deposits were worked at one time but have been closed for some years.

The introduction of natural gas at Hamilton, forming a strong competition to coal gas, has drawn attention to the fact that there is a Dominion statute prohibiting the use of gas containing carburetted hydrogen for lighting. The Minister of Inland Revenue has ordered an investigation, and tests will be made with a view of enforcing the law.

The name of the Department of Lands and Mines has been changed to Lands, Forests and Mines, of which Hon. F. Cochrane is Minister. Mr. Aubry White, formerly Deputy Minister of Lands and Mines, has been gazetted Deputy Minister of Lands and Forests. Mr. T. W. Gibson, formerly Director of the Bureau of Mines, has been gazetted Deputy Minister of Mines.

Promoters of mining companies would do well to remember that the act of last session of the Ontario legislature respecting prospectuses is now in force. It requires prospectuses of every company selling shares or debentures in Ontario, whether chartered under the laws of the province or otherwise, to be filed with the Provincial Secretary and to be given to every purchaser or intending purchaser. A penalty is attached to neglect of this requirement.

Dr. Haanel, Superintendent of Mines, has sent to the Governor-General a specimen of pig iron smelted by electric process during the recent experiments at Sault Ste. Marie. The pig iron has been beautifully ground and bevelled and enclosed on an ebonized frame. Its smooth and shining surface, which looks like steel, bears a suitable inscription in red letters. Samples of the pig iron in the form of paper weights with suitable inscriptions have been forwarded to the Prime Minister and Members of the Cabinet.

Regulations passed several years ago in Ontario with reference to corundum lands have been revoked, except in the case of special agreements with J. N. Shenstone and B. C. Craig in 1899 and 1890, with the Canada Corundum Co. in 1903, and with the Corundum Refiners, Limited, in 1904 and 1905. These agreements were made to encourage the establishment of corundum works at a time when the enterprise was in its initial stages. Henceforth corundum properties will be dealt with the same as other mining lands.

Part III of the Bureau of Mines Report for Ontario has just been issued. Its chief feature is Prof. Coleman's final report on the Sudbury Nickel fields, which he has been investigating for the past three seasons. In a chapter devoted to the uses of nickel, Prof. Coleman advocates a pure nickel coinage instead of the nickel-copper alloy now used in Canada. Switzerland, Austria-Hungary and France have adopted it. It has many advantages. There are two companies at work at present in the nickel field. The Canadian Copper Co. and the Mond.

Mr. H. Baker, of Berlin, Germany, who represents the Canada Corundum Co. in Germany and Russia, has been on a visit to Canada, and with Mr. Craig visited the mines and mill at Craigmont. The company is now turning out over 300 tons a month, and will increase that amount in the near future. At the time of writing a shipment of 200 tons is on its way to Berlin. A new deposit of corundum is being opened up, of a more gem like character, which it is considered will be better for certain purposes. There is a large hill, with millions of tons of this saphire like corundum in sight.

In addition to the mines act three measures relating to the mining industry were passed at the recent session of the Ontario Legislature. One was to amend the act to prevent the waste of natural gas and to provide for the plugging of all abandoned wells. This will have a tendency to prevent waste in our natural gas supply. Another relates to the town of Bruce Mines and the Copper Mining and Smelting Co. of Ontario and validates an agreement by which the town undertook to exempt the Copper Co. from taxation to an extent exceeding the powers conferred upon municipalities, under the general act. The third legalizes an agreement between the Company owing the Port-Arthur blast furnace for iron ore and the owners of the coal and ore dock at that town.

The bills to impose a tax on mineral lands, and to authorize a bonus to a smelter for Cobalt ores, were dropped at the late session of the Ontario legislature, there not being time to consider them fully, but it is probable they will come up again next session. The former meets with considerable opposition. A bonus will be given to a smelter, only if the money comes in some form from the mining industry, and not out of the general funds of the province. A free site has, however, been promised to the Silverland Development Co., which has secured the right to use the German Schneiberg process and a suitable place is being looked up on the line of the Temiskaming & Northern Ontario, where there is little timber or agricultural land, the fumes from the smelter being most destructive to vegetable life. The smelter will cost about $600,000 and will be in charge of two German experts. Argentite Mining and Smelting Co., recently organized, to carry on Mining, also proposes to build a smelter if it can secure government assistance, and Mr. Norton, its manager from New York, has been in Toronto and North looking over the ground.

COBALT.

Silver and gold ores have, it is reported, been found in the township of McLillan, near Sudbury.

The De Forest Wireless Telegraph Co. propose to establish their system between Haileybury and Toronto.

What is described as a silver nugget, weighing 400 pounds, but which is really a mass of silver ore, was recently taken out of the 215 foot level of the Larose Mine.

The building of the T. and N. O. Railway has preserved the bulk of the trade of this great northern district for Toronto, which otherwise would have been diverted to Ottawa and Montreal.

The Abittibi region is full of great mineral possibilities like those which have rendered the Cobalt district famous. The latest reported discoveries made around Lake Abittibi are most promising.

Professor Miller, provincial geologist and party, will thoroughly explore the Gillies limit during the summer, and in the fall the government will begin mining operations.

The Caldwell-Mulock iron property at Temagami is to be worked this season under the direction of Prof. Wilmot. A number of copper properties on Lake Temagami are also being opened up.

The mining property owned by Shillington and Powell, of Ottawa has been sold for $40,000. They bought the claim last fall for $250 and during the winter spent a little money in development.

By an order in Council the township of Coleman, except Cobalt and Kerr lakes, has been set apart as a special mining division under the mines act of 1906, with G. T. Smith as Mining recorder, with office at Haileybury.

The cases of McLeod vs. Lawson and McLeod vs. Crawford, the facts of which were given in the April Review, have gone to the Court of Appeal. Argument has been heard and judgment reserved.

A suit has been entered by E. Gauthier against E. Richards, of Cobalt, for the specific performance of an agreement for the sale and delivery of 500 shares in the Foster-Cobalt Mining Co., or damages to the amount of $1,000.

Dodge vs. Cobalt Merchants Mining Co. is an action arising from a dispute over mining claim No. 220 recorded in the Temiskaming Mining Division. The question is whether an agreement should be carried out, the time which was agreed upon having expired.

A suit has been entered by C. D. Scott against M. G. Hunt and the Red Rock Mining Co., to prevent Hunt from dealing with money or stock of the company, and the company from giving Hunt stock until a matter in dispute is settled. Thirty acres of mineral land is involved.

Machinery is being installed at the Columbus Mine near Cobalt. As the shaft went down the vein matter improved in a very marked way, but a considerable inflow of water was encountered, making necessary the installation of a pumping plant.

The explosion of seven and a half tons of dynamite at Cobalt has drawn attention to the danger of keeping such a large amount of explosives in one place. That such an explosion could take place and no one be seriously hurt is little short of miraculous.

The Montreal Cobalt Mining Company, who have a claim of 107 acres of mining lands on the Montreal River, adjacent to the Gillies limit, are making active preparations for development work. A diamond drill has been ordered and a large force of men will be employed.

The Cobalt Contact Silver Mines Co., Limited, has purchased the property of The Green Silver Mines Co., Limited. An order in Council has been passed authorizing a change of name from the latter to the former. New York capital is interested in the purchase. It is proposed to divide the property into single acre blocks and lease the alternate ones on working conditions, as is done in some of the western mining camps.

The statement which has appeared in some of the newspapers that the proceeds from the sale of mineral rights and percentage from minerals mined on the Cobalt town site and the right of way of the T. & N. O. Railway, are to be applied to an extension of the railway to James Bay, is unauthorized. The money will go into the general funds of the commission and may or may not be used for an extension.

The Cobalt Standard Mining Exchange is about to erect a building to cost $20,000, on a lot for which $15,000 cash was paid, or $215 a foot. Property on the Main Street of the northern silver town is soaring. Latchford, 8 miles south, at the crossing of the Montreal River, is also growing. In prospecting for gold north of the town a 12 inch vein of quartz carrying gold and copper was discovered. Cobalt-bloom and calcite were also found.

Considerable interest is taken in the system of hydraulic prospecting by washing the soil and moss off the rock by means of a powerful stream of water, instead of trenching, which has been in use hitherto at Cobalt. The water will have to be pumped, but even then it will be cheaper and more effective than trenching. A great deal of the prospecting done last year was very superficial and it is probable some rich veins have been passed over.

The terrific explosion of 7½ tons of dynamite at Cobalt, on May 18th., did very little damage as compared with what might have happened. A few panes of glass were broken, some shacks destroyed, and a number of persons received bruises, contusions, and suffered severe mental distress, as the court reporters say, but otherwise the explosion seemed to have done but little harm. About fifty houses in the French section were, however, burned when the fire that had been raging in the near-by woods spread to the town.

The question of the supply of pure drinking water is still the great and pressing need, though it is now about to be met as a firm of Ottawa contractors have secured the franchise for the new water and electric light service to be installed in the town, and in time extended to all the surrounding camps.

Construction work is to commence immediately, and water will be conveyed in pipes from Clear Lake. The franchise is to extend over a period of ten years. The water rates are to average $2.50 per quarter. Arc lights are to be $6 and $8 per annum. The contract price for the plant is $60.000.

A dispute has arisen between one Pettifer and one Sands over an iron property at Temagami. Sands was informed by a J. P. that if he wished to obtain the property he must have a survey made, and he ordered it to be done. Before it was made the statutory time had expired, Pettifer, who had been negotiating for its purchase, then applied for the property and complied with the conditions. The Minister of Lands and Mines has staged the lease to Pettifer pending an investigation and the matter will probably go before the courts. The point is whether the fact that Pettifer was dealing with Sands for purchase precludes him from getting a lease.

The silver property of W. R. Smyth, M.P.P., adjoining Clear Lake, immediately south-west of the town site of Cobalt has been sold to the Clear Lake Mining Co., which will proceed with development work at once. Mr. Smyth retains considerable stock in the company. The same company will work a vein of rich ore under Clear Lake, which has been discovered by means of the diamond drill.. They will immediately proceed to sink a shaft, the water being kept out by means of a crib. The property is owned by Messrs W. J. Gren, Hyland and others of Toronto and the diamond drill tests were made by Major Gordon. The Clear Lake Mining Company, which will work the two properties, will be capitalized at $650,000.

As was anticipated, a great deal of litigation has arisen in connection with Cobalt mining properties. One of the most important cases is that now being tried before Chancellor Sir John Boyd, without a jury, at the Toronto assizes. It is brought by the Attorney General of Ontario against Edward C. Hargrave, of Bay City, Mich., F. M. Rutherford, of Niagara Falls, C. G. Williams, of Montreal, and the White Silver Mining Co., of Toronto, to set aside the leases for 80 acres of mining lands which it is alleged were obtained by fraud. The claims were staked out by George Hanes, of Windsor, who swore that he discovered valuable mineral. Douglas C. Raymond, a student of the School of Practical Science, Toronto, had also applied for leases of some of the claims which Hanes staked out. A large number of witnesses are being examined, and the case is stubbornly fought. From the large interests involved and the valuable property at stake it is probable the case will go to the Privy Council before it is finally disposed of. There are a number of other similar cases.

The Temiskaming and Northern Ontario Railway commission, which recently called for tenders foi mining concessions on the town site of Cobalt and on the right-of-way of the railway, has accepted the offer of the Cobalt Town Site Mining Co., a joint stock company made up of a consolidation of all the interests involved for the south-west 37 acres of the town site. The company pays a cash bonus of $35,000. For the north-west 40 acres negotiations are going on with one of the tenderers. For mining rights on the railway right-of-way nothing could be done in consequence of the action taken by the La Rose Mining Co., which applied for an injunction restraining the commission from disposing of or dealing in any way with the minerals on that portion of the right-of-way which runs through mining location J. S. 14, which belongs to the La Rose Mine. When the question came up for argument it was established that the La Rose Co. had no right to the minerals on the right-of-way, that they were specially excepted in the lease, and that the company paid rental and purchase for only 37 acres, the other 3 acres out of the 40 belonging to the commission. The injunction was therefore refused, and the commission is at liberty to award the right. It is understood that a number of offers have been received. There are also mining rights on some small lots to be disposed of, which the commission has decided to grant to each of the individuals interested, if they wish them.

NOVA SCOTIA.

The Micmac Gold Mining Company is a combination of three properties on the well-known Leipsigate fissure vein, of which Mr. E. R. Faribault of the Geological Survey of Canada, Professor Crosby of the Mass. Institute of Technology and Professor Preswick of Cornell University, have been pleased to take special notice.

The last 21,000 tons or ore taken out of this vein yielded over $216,000.

A meeting of the shareholders of the Breckenridge & Lund Coal Co., was held at Lundbreck, Alta., recently. The company's business was found to be in a very satisfactory condition. A 600 horse power engine and boiler, with up-to-date mining machinery, is now installed, the working shaft is 360 feet deep, and goes through coal all the way down, except about twenty feet of surface. The machinery is capable of lifting screening and shipping 800 to 1,000 tons per day. The coal is a fair domestic coal, and is in great demand wherever it has been tested. The town of Lundbreck is called after the mine.

The installation of the new 100 H. P. Boiler at the Micmac is completed and it will immediately be put into use. The shaft house is now supplied with three boilers of this size and they have just enough power to keep development work going until electric power is brought to the mine.

The drifting for the month of April opened up something over $100,000 in ore. What the management believes to be the record for drifting in quartz and whin-rock, was brokin in the 300 foot level east. This drift was driven 101 feet in 26 double shifts with a MacKiernan 2¼ inch drill, handled by one man. The cost for running this drift was $2.35 per foot, including its proportion of the pumping and hoisting expenses. The 15 stamp mill is running night and day on quartz taken out in development work.

COAL NOTES.

Shipments have been fairly active from Port Hastings.

A census of Frank lately taken shows that town to have a population of slightly under 700 people.

There are two hundred men on the pay roll at the Allan Shafts. The number is being added to daily

According to Mr. Fred. Wanklyn, the Dominion Coal Company will make the largest output of its history this season. The coal is in demand and sales are excellent.

The strike at Springhill was arranged by a compromise. The men asked 38 cents and yardage. They accepted 36 cents straight. This rate should enable them to make a good wage.

The Dominion Coal Co. has a party out surveying a road from their main line to the Company's areas on the Lingan side.

The Inverness Ry. & Coal Co. have purchased a small steamer of light draught for the costal trade.

Shipments from the Springhill Collieries, of the Cumberland Railway and Coal Company for the month of April were 30,980 tons.

The Pacific Coal Co. has ordered two 150 horse power boilers from the Robb Engineering Co. for their mine at Bankhead, Alberta.

The Acadia Coal Company is making extended improvements and additions at the Allan shaft, and expects to have a largely increased output of coal as soon as these improvements are completed.

A C. P. R. surveying party has begun work locating a line to the Diamond Vale Coal Iron Company's mines on Quilchena Creek, through which they pass on their way through Aspen Grove en route to the Similkameen.

Mr. John W. Johnston is manager of the Mabou Colliery, N.S. He was recently in Westville, arranging for shipping facilities during the season. The Mabou coal meets with a ready sale for domestic and steam uses.

The Dominion Coal Company are banking a large quantity of coal at the Dominion No. 2 banking station. The bank there has grown to goodly proportions during the past two weeks. There are upwards of one hundred men employed at the bank, which now amounts to about 250,000 tons.

A. C. Curry, of Rhodes, Curry & Co., Sydney, recently visited Dominion No. 2 Caledonia and the other collieries. The Rhodes Curry Company have a large contract for the erection of miners houses for the Dominion Coal Company. In all, 61 houses are to be built at Dominion No. 2, of which twenty-two are now completed. The Company have commenced work on the houses at Dominion No. 6, of which they have erected over two hundred.

The Crow's Nest Pass Coal Company are putting out from 17 to 18 thousand tons per week and the International Coal & Coke Company at Coleman, which is practically still in its infancy, about 6,500 tons per week. They are selling a considerable quantity of coal to the Canadian Northern for shipment to Edmonton.

The bulk of the Crow's Nest coal goes to the Great Northern Railway company and the C. P. R., besides supplying coke to the smelters.

News comes from the Joggins to the effect that the men have had a proposition made to them by the management for a two years contract on the present basis of pay. The Company are contemplating many improvements, and the investment of considerable new capital, but they do not care to go ahead with labor conditions in uncertainty. The men have been well satisfied with their present pay, and it seems certain they will accept. It is also stated that the eompany intends paying the back wages due the men by the old company, amounting to about $7,000. Twenty-six per cent. of the original amount was paid several months ago, and it was thought then that this would be the only dividend the men would get. It now seems reasonably certain that they will get all.

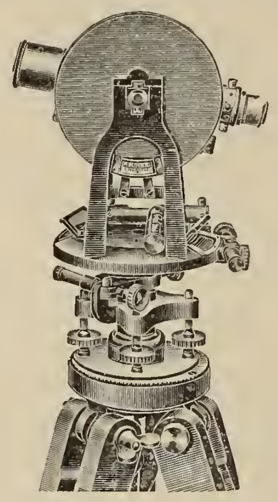
The management of the Acadia Coal Company has employed a large number of men with teams to grade their grounds in the vicinity of the Allan shafts. The large seam of 47 feet thickness is turning out good coal, while the smaller 19 foot seam in No. 2 shaft is also proving excellent. The new steel bank-head will cost $50,000.

Important experiments are being carried on by the naval authorities at Portsmouth to ascertain the extent of the steaming properties of Welsh coal which has been improved by storage in the sea. Eighteen months ago iron crates each containing two tons of coal, were sunk in the big basin in the dockyard. At the same time a similar quantity of coal was carefully stored in the open air at a coaling point and sheltered by tarpaulins. At intervals of six months two ton samples of each storage have been taken carefully and burned. The results have shown conclusively that by the submarine storage of coal its calorific value steadily increases, while by storage in the open air a decided decrease is shown. At naval coaling stations in the tropics the decrease in calorific value is very great.

The Admiralty is satisfied with the physical and financial advantages of submarine storage, and has now directed that experiments be made to ascertain its practicability on a large scale. The difficulty is that submerged coal must be dried before it is used, or otherwise the superficial moisture would soon cause spontaneous combustion. Close confinement in the bunkers of warships is the only method of drying heretofore attempted. Spreading quantities of thousands of tons in the open air has not been feasible.

THE DAVIS PROTECTED TRANSIT.

Every engineer who has had to use surveying instruments in mines or in a difficult country knows how much trouble ,dirt, and dust, and wet can cause. Messrs. J. Davis and Co., Limited, of Derby, England, have brought out a transit instrument specially designed for surveying in metal mines. The principal feature in this is that all the circles, verniers, draw tubes, and screws are protected by metal covers, the verniers being read under glass. The telescope is 7½ in. long, and has a 1 in. aperture, the eye-piece being "18 diameters and inverting." Both the object



glass and eye-piece are protected with mud, rain, and dust guards. There is a 4 in. graduated level under the telescope. The horizontal circle is 4 in. in diameter, and is provided with a double row of figures from 0 deg. to 360 deg. The vertical circle is also 4 in. in diameter. The instrument is made either in gun-metal or aluminium, weighing in the former metal 18 lb. 7 oz., and in the latter 15 lb. 4 oz., the weight of the legs in each case being included. The cut shown herewith gives a good idea of the instrument.

BOOK REVIEWS.

A Guide to Minerals and Rocks.—Prof. Willet G. Miller, Provincial Geologist of Ontario, is the auther of a new book on the study of minerals. This little work comes out at a very opportune moment, having been written for the instruction of those who have but a rudimentary knowledge of rocks, minerals and geological phenomena. Professor Miller occupied the chair of geology in the School of Mining at Queens', and having had a long experience in teaching, is enabled to handle the somewhat difficult subject he has chosen, in a lucid manner.

He deals firstly, with the materials which go to make rocks, and then gives some examples of the occurrence of these rocks in the more get-at-able parts of Canada. He has chosen photographs to illustrate his subjects, and we think they have been well chosen; they are certainly far more illuminating than the usual diagrammatic cuts which are used in such books.

The physical characters of minerals are explained at some length, and the minerals are themselves illustrated from photographs. Characteristic fossils are also shown, and the geological history of the world is touched upon as fully as the limited space at command permits. Moreover, the economic side of the subject is not neglected, while chemical and blowpipe tests are given that should enable any reader of ordinary intelligence to determine the simpler metals. A very good feature of the book is a table giving the commercial value of certain minerals, ores and metals. There is also a good bibliography for the guidance of those who would delve deeper. The Copp, Clark Company are the publishers; the price is $1.00.

Producer Gas.—The latest, and in many respects the most thorough, treatise on Producer Gas and Gas Producers is that by Samuel S. Wyer, recently published by the Engineering and Mining Journal, New York. The use of fuel gas has attracted considerable attention, and important advances and industrial developments have been made therein quite recently. These will be found minutely contained in this well written book. The author is at the head of his profession, and is an acknowledged expert on producer gas. His numerous experiments should prove interesting and useful to all chemists, metallurgists, ga engineers and others who wish to keep themselves posted in an important branch of metallurgy. Price $4.00.

INDUSTRIAL NOTES.

The Golden Horn Mining Company have purchased a Huntington mill from the Allis-Chalmers Bullock Co., of Montreal. The contract calls for delivery this summer.

The Penn Hardware Company, Reading, Pa., are installing a 150 horse power Koerting gas engine to be run on producer gas furnished by a Koerting suction producer. The entire plant is supplied by the De La Vergne Machine Co., New York.

The Rush Bay Golden Horn Mining Co., of Rat Portage, Ont., recently purchased from Allis-Chalmers-Bulloek, Limited, Montreal, a mining plant including a Huntington Mill, two Overstrom Concentrators, and Accessory Machinery.

In addition to the office recently established in Oakland, at No. 906 Broadway, the Allis-Chalmers Company, Milwaukee, Wisconsin, has opened quarters in the Atlas Building, 602 Mission Street, "New" San Francisco, where its representatives may be found in readiness to transact all necessary business.

The *Financier and Bullionist*, of London, issued on April 28th a very handsome special Canadian supplement. The great industrial and agricultural development that is going on in the Dominion was laid before the readers of the *Financier and Bullionist* with great detail and considerable utility. Such special specimens should be of value in calling attention to the attractions of Canada as a field for investment.

The Fulton Iron Works, San Francisco, have notified the Canadian Mining Review that their entire stock of catalogues, bulletins, circulars and photographs were destroyed in the recent fire in that city. Patrons of the firm will have to wait a little time for bulletins such as the firm has been in the habit of issuing. It will not be long, however, before, with characteristic energy, the Fulton Iron Works will be running as of yore.

A new electrolytic generator, which will have the effect of more than doubling the capacity of the electrolytic refinery of the Canadian Reduction works at Trail, B.C., has been ordered from the Canadian General Electric Company's works at Toronto. The new set is rated at 400 kilowatts. There are two sets of generators in use each being rated at 122½ kilowatts. The new set is, therefore, more than 2½ times the capacity of those in use. The plant ordered will cost $20,000.

Messrs. W. H. C. Mussen & Co., of Montreal, have been given the representation of the Wilfley Ore Concentrator Syndicate's manufactures in Canada. These machines are the Wilfley slime tables and the McDermott sizers. They are consequently the only firm authorized to offer Wilfley tables in the Dominion. Of these tables there are 250 already in use in the different mining camps of the world. The McDermott sizer was designed for a more accurate sizing of crushed before dressing.

The Canadian Rubber Co. of Montreal, Limited, have now placed on the market their new "Keystone" Side Wire Tire. This Tire has many features not to be found in any other make. The company have exclusive control of the patent rights for manufacture and sale throughout the Dominion. A large amount of business has been booked, and the carriage and hack trades are displaying great interest in the new Tire, which is adjudged by experts to be superior to anything yet put on the market.

The Kobbe Company, 1 Hudson Street, New York, are sending out a copy of H. D. Crippen Mfg. Company's new catalogue No. 10, covering the design and application of the Box Electric Drill. In addition it contains full information on electric hoists, blowers, generators and converter sets, in fact it deals with everything required for a complete electric mine installation.

Messrs. Keating & Duncan announce that they have opened offices at the Home Life Building, Victoria Street, Toronto, where they will carry on business as Civil Engineers, special attention being given to Hydraulic, Municipal, Electrical and Industrial undertakings.

The Sullivan Machinery Company, of Claremont, N.H., and Chicago, Ill., has issued a very neat pamphlet, entitled "Coal Mining by Machinery." Its aim is to give a lucid description of the machinery manufactured for coal mining by the Sullivan Machinery Company, together with an outline of the way each machine is used. The Sullivan pick machine, the shearing machine, and the chain electric machines, as well as the Sullivan diamond prospecting core drills and the four-stage and two-stage air compressors, are illustrated and described. This little publication will be of considerable interest to all those who are engaged in mining coal. It will be sent upon application to the Sullivan Machinery Company, Railway Exchange, Chicago, if the CANADIAN MINING REVIEW is mentioned.

The application of electricity to mining, especially where water power is available, is recognized as a handy and economical method of operation. Among recent sales for this purpose by Allis-Chalmers-Bullock, Limited, Montreal, were a 60 h.p. Induction Motor to drive a two-stage Centrifugal Pump and a 50 h.p. Induction Motor to drive a six-stage Centrifugal Pump, with the necessary Transformers, etc., to the Dominion Copper Co., of Phœnix, B.C.; a 900 h.p., two 300 h.p., a 50 h.p., and a 25 h.p. Induction Motor for general work, and a 40 h.p. Induction Motor to drive a two-stage Centrifugal Pump to the Asbestos & Asbestic Co., of Ranville, Que., and a 75 h.p. Induction Motor driving a Compound Air Compressor for general power purposes and a 115 k.w. Generator for lighting purposes to Blackburn Bros. for their Mica Mines at Perkins Mills, Que.

Toronto is to have the most up-to-date fire fighting apparatus in the Dominion, new turbine pumps and power taking the place of the fire engines. This system has been a complete success in Philadelphia.

The turbine pumps now building have a capacity of 5,000,000 gallons of water every 24 hours, at a maximum pressure of 300 pounds to the square inch. The water will be supplied to a high pressure piping net work, covering the district to be protected.

The pumps are always ready to work—the steam is up—and when fire breaks out, all that is necessary is to couple on the hose to the fire plugs, and the water pours out. This does away with fire engines altogether.

The Canadian Westinghouse Company have the contract for this new pumping station and are supplying two 1,100 horse power Westinghouse-Parsons steam turbines.

The pumps are of the two-stage turbine type and manufactured by The John McDougall Caledonian Iron Works of Montreal.

THE MINING AND INDUSTRIAL SHARE MARKET.

(Specially reported for the *Canadian Mining Review*, by Robert Meredith & Co., Mining Brokers, 57 St. Francois Xavier St., Montreal).

The market has undergone a considerable change, during the past month. Prices are firmer, and the volume of business has largely increased. Encouraging news from the mining districts, and the prosperous condition of the country generally, is creating a confidence in the public in mining ventures, and active speculation in these properties seems nearer at hand, than was anticipated some little time ago.

Reports from the Cobalt district are not of a nature to enthuse the speculator. Outside of the few properties that are being worked, and show good returns, there is no actual mining going on. Prospectors and promoters are asking absurdly high prices for locations, and have practically driven would-be investors away.

In industrial shares there has been only a limited amount of trading, but prices are firmer. The most promising amongst them, are the Dominion Iron & Steel issues. Satisfactory reports of the company's condition have given confidence to the public, and made the shares a more speculative commodity.

The latest quotations are as follows:—

	Bid.	Asked.
Can. Cons. Mines	128	132
Can. Gold Fields	06¾	07¼
Granby Cons.	12½	12¾
Rambler Cariboo	23	23½
North Star	04	——
Monte Cristo	02½	03
White Bear	06	06½
California	02	——
Virginia	02	05
Deer Trail	01½	02¾
International Coal	47	49
Sullivan	02½	03½
Jumbo	25	26
Cariboo-McKinney	02½	03
Dominion Coal (common)	78	79
Dominion Coal (preferred)	119	120
Dominion Iron & Steel (common)	30	30½
Dominion Iron & Steel (preferred)	82	83
Intercolonial Coal (common)	——	——
Intercolonial Coal (preferred)	——	——
Nova Scotia Steel & Coal	67	67½
Nova Scotia Steel & Coal (preferred)	——	——

MINING INCORPORATIONS.

ONTARIO AND QUEBEC.

Canadian Iron & Foundry Company, Ltd.—Capital $2,000,000.00 in shares of $100.00 each. Head Office, Montreal.

The Montreal Reduction & Smelting Company, Ltd.—Capital $2,000,000.00, in shares of $5.00 each. Head Office, Montreal.

The Mining and Lands Development Company, Ltd.——Capital $40,000.00, in shares of $100.00 each. Head Office, Toronto. Provisional Directors: Messrs. William Alfred Preston, William James Elliott and Robert Davidson Hume.

Hudson Bay Extended, Limited.—Capital $50,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Mr. John Walter McDonald, Ella Alexandria Francis and Mary Ann McKessock.

The Amalgamated Petroleum Producers, Limited.—Capital $40,000.00, in shares of $50.00 each. Head Office, Belleville, Ont. Provisional Directors: Messrs. Cameron Brown, Hugh Quinlan and William Nesbitt Ponton.

Mining Development and Securities Company, Limited. —Capital $150,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Messrs. Walter Herbert Gates, Edward Stuart, Clifton Griffith, and Harvey Nelson Barry.

Silver Ledge, Limited.—Capital $20,000.00, in shares of $10.00 each. Head Office: Toronto. Provisional Directors: Messrs. Alexander Montgomery, Ewart Reginald Lynch and Alice Scott.

North Cobalt Land Corporation, Limited. Capital $40,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Messrs. Geo. Stevenson, William James Clark, Mary Lambert, Annie Bell and Emeline Roberston.

Findlay Mining Company, Limited.—Capital $20,000.00, in shares of $1.00 each. Head Office: Windsor. Provisional Directors: Messrs. Luke Hitchcock Broadwater, Job Grafton Kimmell and Terrance McManus.

Iroquois Cobalt-Silver Mining Company, Limited.—Capital $100,000.00, in shares of $1.00 each. Head Office: Haileybury, Ont. Provisional Directors: Messrs. Charles Arthur Richardson, Joseph Law Wheeler and Harvey Driffill Graham.

The Silver Cliff Mining Company, Ltd.—Capital $2,000,000.00, in shares of $1.00 each. Head Office: Ottawa. Provisional Directors: Messrs. Walter Dymond Gregory, Henry Folwell Goodheram and Harvey Nelson Barry.

Silver Wonder Mining Company, Limited.—Capital $300,000.00, in shares of $1.00 each. Head Office: Toronto. Provisional Directors: Messrs. Archibalt Thomas Struthers, Lachlan Mackay and William Henry Syms.

The Buffalo Mines, Limited.—Capital $1,000,000.00, in shares of $1.00 each. Head Office; Toronto, Ont. Provisional Directors: Messrs. Alexander McLean Macdonnell, Arthur Carson McMaster and Thomas Herbert Barton.

Glen Lake Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each. Head Office: Toronto, Ont. Provisional Directors: Messrs. Alexander McLean Macdonnell, Arthur Carson McMaster and George Reginald Geary.

The Lake Abitibi Navigation and Trading Company, Limited.—Capital $40,000.00, in shares of $100.00 each. Head Office:Parry Sound, Ont. Provisional Directors: Messrs. John Galna, William Fritz Thomson and William Ross Smyth.

Beaver Silver Cobalt Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each. Head Office, New Liskeard, Ont. Provisional Directors: Messrs. Andrew Devine, Kalil Farah and Louis Vineberg.

Dominion Cobalt Mining and Development Company, Limited.—Capital $450,000.00, in shares of $1.00 each. Head Office: Cobalt, Ont. Provisional Directors: Messrs. Robert Kenneth Lindsay, John Thomas Later, Walter Williams.

The University Mines, Limited.—Capital $1,000,000.00, in shares of $10.00 each. Head Office: Toronto. Provisional Directors: Messrs. Geo. Glendinning, William John Blair and Hugh Livingstone Kerr.

The Columbus Cobalt Silver Company, Limited.—Capital $450,000.00, in shares of $1.00 each. Head Office: Toronto, Ont. Provisional Directors: Messrs. Harry Sydney Pritchard, Frederic Watt and Frederick Clarence Jarvis.

North Range Nickel and Iron Mining Company, Limited. —Capital $1,000,000.00, in shares of $1.00 each. Head Office: Sudbury, Ont. Provisional Directors: Messrs. William Joseph Bell, Alexander Burton Gordon and Joseph Morin.

The Albert Mining Company, Limited.—Capital $375,-000.00, in shares of $1.00 each. Head Office, Toronto, Ont. Provisional Directors: Messrs. Samuel James Pickering, William John Brown and John Lewis.

The Cobalt Chartered Company, Ltd.—Capital $350,-000.00, in shares of $1.00 each. Head Office, Haileybury, Ont. Provisional Directors: Messrs. Frank Law, Allan Lebeau, Edward Eugene Belcourt, Joseph Napoléon Rattey and Henri Letourneau.

The McKinley-Darragh-Savage Mines of Cobalt, Ltd.—Capital $2,500,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Mr. Geo. Wishart Spence, Ada May Duncan, Ada Agnes Rogers, Lilian Murray Heal and Susan Whittaker.

Cobalt and Hudson Bay Development Company, Limited.—Capital $100,000.00, in shares of $1.00 each. Head Office: Haileybury, Ont. Provisional Directors: Messrs. James Edward Day, John Michael Ferguson, Edward Vincent O'Sullivan, Arthur Herbert Day and John Joseph O'Sullivan.

The Cobalt Standard Mining Exchange, Limited. Capital $40,000.00, in shares of $10.00 each. Head Office: Cobalt, Ont. Provisional Directors: Messrs. John Walter McDonald, Herbert Langell Dunn, Albert Ernest, James Blackman, Ella Alexandria Francis and Mary Ann McKessock.

The Eureka Silver Mining Company, Limited.—Capital $100,000.00, in shares of $1.00 each. Head Office: New Liskeard, Ont. Provisional Directors: Messrs. Byron Field, Edward Milton Goodman, James Leitch Brown, Robert Herron and Henry Hartman.

The Silver Crown Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each. Head Office: North Bay, Ont. Provisional Directors: Messrs. Robert Handley, John James Connolly, Charles James Murphy, Charles James Roberts and William Pennington Allum.

The Steep Rock Development Company, Limited.—Capital $150,000.00, in shares of $1.00 each. Head Office: Fort Frances, Ont. Provisional Directors: Messrs. David Croal McKenzie, Alexander Mills, Thomas Rawn, George Webster and Adeliner Snyder.

Montreal River Silver Syndicate, Limited.—Capital $200,-000.00. Head Office: Toronto, Ont. Provisional Directors: Messrs. William Hamilton Wylie, William John Aikens, Richard Thomas Mussen, Charles Exley Calvert and William Thomas Henderson.

The Gilpin Cobalt-Silver Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each. Head Office, Toronto, Ont. Provisional Directors: Messrs. Arthur Albert Daniel, Robert Frederick Wilton, D'Arcy Bolton Gilpin and Mildred Wessonah Mayer.

The Sudbury Cobalt Mining Company, Limited.—Capital $300,000.00 in shares of $1.00 each. Head Office: Sudbury, Ont. Provisional Directors: Messrs. John Timothy O'Connor, Delphis Matthew Morin, Lawrence O'Connor, Norman Thorquil Hillary and James Arthur Mulligan.

The Cross Lake Consolidated Mining and Milling Company, Limited. Capital $1,000,000.00, in shares of $1.00 each. Head Office, Toronto, Ont. Provisional Directors: Messrs. Frederick Rielly, Henry Mortimer Murton, John Bogert Bartram, Grace Sutherland and Edna Denton.

Wendigon Silver and Copper Mining Company, Limited.—Capital $400,000.00, in shares of $1.00 each. Head Office: Windsor, Ont. Provisional Directors: Messrs. Andrew Green, John Alexander Hunt, James Wesley Hanna, John Wigle and Albert Doumouchelle.

Argentite Mining and Smelting Co., Limited.—Capital $1,000,000.00, in shares of $100.00 each. Head Office: Toronto. Provisional Directors: Messrs. Geo. Charles Loveys, William Beardsley Raymond, Frank Ford, John Francis Hope McCarthy and James Miller Ewing.

Lawson Cobalt Silver Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each. Head Office: Eganville, Ont. Provisional Directors: Messrs. Walter Lawson, Donald Fisher McGregor, John Brady, Duncan James McEwan and John Leopold George.

Ontario Iron and Steel Company, Limited—Capital $500,-000.00 in shares of $100.00 each, of which two thousand five hundred shares to be Preference Shares. Head Office: Toronto, Ont. Provisional Directors: Messrs. David Muhlfelder, Joseph Lippman Steefel and William Manley German

Wolstrees Cobalt Silver Mining Company, Limited.—Capital $250,000.00, in shares of $1.00 each. Head Office: Windsor, Ont. Provisional Directors: Messrs. John William Wolst, Frederick Stephen Kratzet, Anthony Brinkmann, Charles Olin Campbell, Alexander Campbell, Francis Herbert Warren and George Henry Hett.

The Windsor Dredging Company, Ltd.—Capital $40,000.00, in shares of $100.00 each. Head Office, Windsor, Ont. Provisional Directors: Messrs. Albert Frederick Healy, Adolphe Peltier, William Johnson McKee, Henry Wm. Allan, Arthur Bertram Drake, Geo. Erasmus Brooks and Walter Leishman McGregor.

The Green Rock Mining Company, Limited.—Capital $600,000.00, in shares of $1.00 each. Head Office, Sault Ste. Marie, Ont. Provisional Directors: Messrs. Charles S. McLachlan, John Burk Kelly, William Henry Darcy, James Johnson Lyon, George Franklin Wheatley, Robert Chadwick and Robert Henry.

The Detroit & Cobalt Development Company, Limited.—Capital $25,000.00 in shares of $100.00 each. Head Office: Windsor, Ont. Provisional Directors: Messrs. John Lawrence Ernst, Clarence Howard Gowman, William Henry Lehman, Alexander Gould Thomson, Timese Lemay and Orrin Preston Gulley.

The Ohio Cobalt Mining Company, Ltd.—Capital $60,000.00, in shares of $10.00 each. Head Office: Haileybury, Ont. Provisional Directors: Messrs. Howard Hugo Smith, John Charles Ross, Benjamin Rush Dawson, William B. Francy, Andrew Scott Buckingham, Robert Morse Francy and Hervey Garrett Mooney.

BRITISH COLUMBIA.

The Phœnix Amalgamated Copper Mines, Limited.—Capital $5,000,000.00, in shares of $10.00 each.

Bear Hydraulic Mining Company, Limited. Capital $250,000.00, in shares of $1.00 each.

Canada Western Oil Company, Limited. Capital $500,-000.00, in shares of $1.00 each.

Phœnix Amalgamated Copper Mines, Limited.—Capital $5,000,000.00, in shares of $10.00 each.

DOMINION OF CANADA

SYNOPSIS OF CANADIAN NORTH-WEST MINING REGULATIONS.

COAL—Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of 10 cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ—A free miner's certificate is granted upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner having discovered mineral in place, may locate a claim 1,500 feet x 1,500 feet.

The fee for recording a claim is $5.

At least $100 must be expended on the claim each year, or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey, made, and upon complying with other requirements, purchase the land at $1 an acre.

The patent provides for the payment of a royalty of 2½ per cent. on the sales.

Placer mining claims generally are 100 feet square ; entry fee $5, renewable yearly.

A free miner may obtain two leases to dredge for gold of five miles each for a term of twenty years, renewable at the discretion of the Minister of the Interior.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles. Rental $10 per annum for each mile of river leased. Royalty at the rate of 2½ per cent. collected on the output after it exceeds $10,000

W. W. CORY,
Deputy of the Minister of the Interior.

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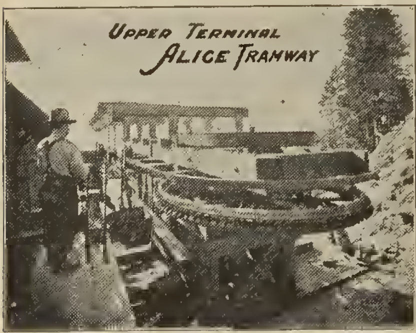

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COST OF OPERATION: ONE MAN'S WAGES.

More Riblet Tramways built last year than all others combined.

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CROWN BRAND

Manufactured by

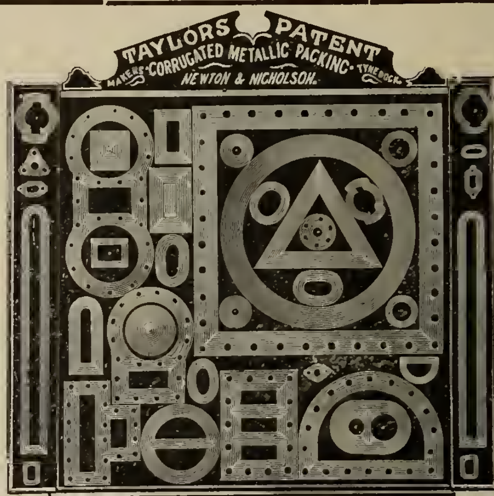
WILLIAM BENNETT, SONS & CO.

Camborne, Cornwall, England

CANADIAN OFFICE:

BENNETT FUSE CO., YATES ST., VICTORIA, B.C.

AND AGENCIES THROUGHOUT THE DOMINION



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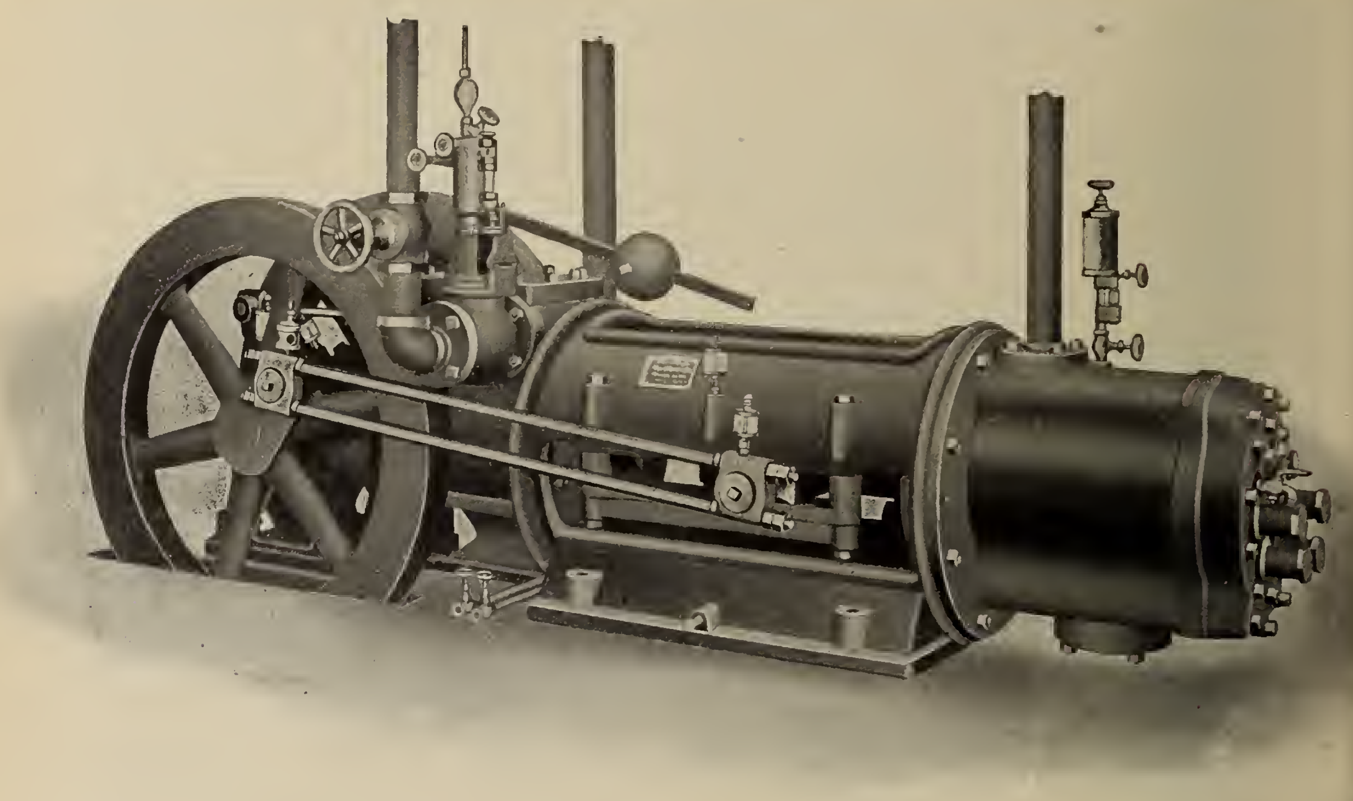

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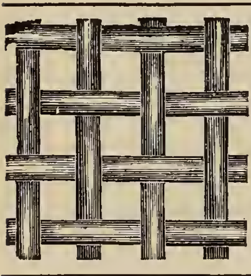

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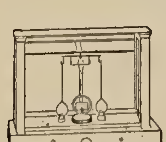

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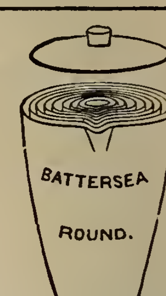

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CONTENTS.

The monthly analysis of gold production in the Transvaal for April shows that there were produced 420,467 ounces of fine gold, valued at £1,786,030. Of this total 274,079 ounces were contributed by the plates; 9,738 ounces obtained from concentrates; 111,754 ounces from sands, and 24,694 ounces from slimes.

Prof. John Macoun will make an examination of the country along the line of the Grand Trunk Pacific Railway between Portage la Prairie and Edmonton, but especially west of the proposed crossing of the Assiniboine. In making this examination he will touch at certain points examined and reported on by him in 1872, 1879 and 1880, and will be able to make a much more reliable report on this account, as he can compare his notes taken in former years with those made on this expedition.

From the matured knowledge of the natural history, climatology and natural resources of the country, a valuable and exhaustive report may be expected. Besides reporting on the soil and climate in the immediate vicinity of the road, he will be able to speak with more certainty about the future of Saskatchewan and Alberta than he was able to do in his earlier reports.

Enough material and notes on the fauna and flora of northern Saskatchewan and Alberta will be obtained to enable the department to publish a comprehensive report on these subjects. Competent assistants will accompany Prof. Macoun, who will collect birds, mammals and plants for the Museum.

Most Canadians are aware that we have in this Dominion supplies of coal to express the amount of which our language falls lamentably short. "Enormous," "tremendous"—such words as these only feebly express the tonnage of lignite lying beneath the thousands of square miles in the western provinces. Unlimited is perhaps the correct word, for the supply is certainly "unlimited" for many hundreds of years. A billion, to the ordinary person, is little more than a figure of speech, but the tons of coal in Alberta alone are probably represented by hundreds of billions.

Though the presence of this coal is well known, and has been known for some time, the fact that it is only "lignite" has been sufficient to induce most people to believe that its economic use is comparatively small.

An invention has, however, been patented which has all the possibilities of rendering this lignite quite as useful as hard Welsh anthracite. This invention, known as a gas producer, has been put to very severe tests, and has proved that coal similar to our western lignite can be made to produce, by its aid, an amount of power equal to that produced in the ordinary way by best Welsh.

Mr. Dowling, of the Geological Survey, lately read, before the Mining Institute, a paper in which he gave some remarkable figures. These show that in an ordinary steam plant the amount of coal (similar to that found at Medicine Hat) required to produce one horse-power per hour is six pounds, whereas in the gas producer a similar result is obtained from less than two and a quarter pounds. This test was made on what is known as "wet" coal, but if the coal be dry, the variation is equally startling. These extraordinary results open up a field whose limits are practically boundless.

The Geological Survey has recognized the tremendous possibilities and their reports on the western coal areas will be read with more than usual interest.

The ultimate object of the mining industry is to extract from the earth's crust various mineral substances required by mankind and bring them to such a condition that they become of value, either as a means of currency or display, or as material for the manufacturer.

Once this is allowed, it is evident that the community at large is interested in having the most made of the resources of its country, and in having the supply of the material it needs produced as cheaply as possible, that is, with the minimum of expenditure of time, material and enrgy. This requires that those having the direction of the operations for mining these mineral substances should be armed with the fullest possible information and should come to their task with a thorough knowledge of the nature, modes of formation and habits of the deposits to be worked.

It has long been recognized that a legitimate and important branch of the work of a Geological Survey consists in presenting to the public an annual review of the economic condition of the mining industry, including, whenever possible, technical data required by practical miners regarding the economic mineral deposits of the country. Such a report has been issued by the Dominion Survey since 1886 and, although it often runs to some two hundred pages, the matter is so arranged as to show at a glance the present state of the mining industry in Canada.

Often the accumulation of the data required for the completion of the annual report is made with the greatest difficulty, because some operators, directly they are asked for facts, curl, snake-like, into their shell and refuse to give any particulars whatever, believing, apparently, that the information will be used somehow against them.

The Survey's policy is, and always has been, to publish nothing that can damage legitimate private interests, and the director appeals to all mining men to help as much as possible in furthering the work of the Mines Section of the department, so that the interests of the mining community at large may be likewise helped.

SOMETHING IN A NAME.

Nine years ago, His Excellency the Governor-General, by and with the advice of the Queen's Privy Council, was pleased to create a "Geographic Board." This body was to consist of and has consisted of one member for each of the departments of the Geological Survey, Railways and Canals, Post Office, and Marine and Fisheries, such member being appointed by the Minister of the department; of the Surveyor General of Public Lands, of such other members as may from time to time be appointed by Order-in-Council, and of an officer of the Department of the Interior, designated by the Minister of the Interior, who shall act as secretary of the Board.

This carefully appointed body, consisting as it does of the best informed men in the Dominion, seems to have had about as much effect upon the spelling of Indian names as if it had never existed. The daily papers, even those in the front rank, continue to spell such words as "Abitibi" in a dozen different ways. They persist in calling "Sassaganaga" (Island Lake) "Sissiginaga," and "Lake Timiskaming" is "Temiscaming," "Temiskaming" or even "Temiscamingue." All these Indian names have a very definite meaning, and they are not to be confounded with some of the idiotic appellations given by the earlier white settlers. The Indian name usually refers to some marked physical peculiarity. For instance, "Timiskaming" means "Lake of the Deep and Shallow Water," and if you have ever been on "Timiskaming" you will recognize the fitness of the designation. The lake itself is six hundred feet deep, but the bays between headlands are usually extremely shallow.

Seeing that the Fifth Report of the "Geographic Board" is to be obtained in exchange for a ten cent piece, we think there is no excuse for Canadian editors when they misspell names of places in the Dominion. We have too much of what may be called "Brass Band Patriotism," and it is worth while considering whether it would not be better to show our love for this Canada of ours by taking at least sufficient trouble to learn its geography thoroughly.

LET THOSE WHO RUN, READ.

The Department of Mines and Geological Survey of New South Wales is issuing a series of bulletins upon the mineral resources of New South Wales, similar in their nature to those that are issued by the Canadian Geological Survey, and which have attracted such favorable comment. Bulletin No. 11, by E. C. Andrews, B.A., deals with molybdenum. We are impressed with the very practical nature of this bulletin. No attempt whatever has been made to render it intelligible only to the trained metallurgist—the very man who needs it least. Rather has it been written for the uneducated prospector, for whose guidance it has been prepared. One continually finds little explanatory sentences that will make the meaning clear even to men of slight education. We think that there is much wisdom in this course, and when pamphlets are written in order to aid the prospector, the language, while it should be accurate and precise, need not be too technical.

The value of molybdenite exported from New South Wales varied between fifteen and twenty-nine tons for the years 1902, 1903 and 1904. The higher figure was reached in 1903, when the value of the product was £4458. In New South Wales molybdenite has been found generally at the contact of coarse and fine sandstone-like granites with older rocks. The latter may be rocks of all descriptions, such as porphyries, felsites and andesites, but usually the contact with slate is the most productive. Some very sensible remarks concerning the occurrence of quartz reefs are worthy the attention of prospectors in other countries than New South Wales. The writer says:—

"A few remarks concerning the occurrence of quartz reefs generally will not here be out of place. The author has seen men jubilant at the discovery of reefs such as the one described above. Prospectors often contend that the narrow outcrop will 'be sure to improve in depth' both in width and value. Now, this is against all experience, and the mass of experience is simply the basis of all mining geology.

"Let us examine an outcrop with respect to its life at a depth, irrespective of its mineral values. If the reef is very narrow all along its course, and can be traced some two or three chains only along the surface, we may rest assured that usually this class of reef will pinch out below at little or more than one hundred feet. If the outcrop widens here and there, and can be traced along the surface for a mile or more, we may be sure such a reef will live to great depths, and that frequently it will widen out and "pinch" as it is traced downwards.

Again, if one finds molybdenite (or other mineral) scattered sparsely at intervals only along an otherwise barren vein of quartz, one may rest assured that such a line will be very patchy. Again, with few exceptions, one will find the outcrop, or the reef near the surface, to carry much bigger values than at depth.

"Along many reefs shoots of ore occur, while the vein alongside is valueless. It will often be found, in such cases, that a cross-course or peculiar "bar" of country is associated with the rich shoot."

A WORD IN SEASON.

In these summer days, when the streets of our larger cities are full of stories concerning the "marvellous" wealth of the Cobalt region, of the Chibogamoo country and of the unknown north through which the Transcontinental Railway is building, we came across the following excellent editorial in the June number of our highly esteemed contemporary, *Mines and Minerals*. And, believing that neither New York nor Arizona can equal in mining ignorance either Montreal or Toronto, we reproduce the article in the vain (?) hope that some of our otherwise respected Canadian citizens may take heed thereof and be, for once, wiser than his neighbor, and wise in his generation:—

A lawyer recently borrowed from our library a book on gold mining in order that he might go to Australia for a New York syndicate to report on a gold mine. He had neither technical training nor practical experience, still a number of bankers who rank as conservative financiers were willing to accept a report based upon a knowledge of the geology and of occurrences of gold veins and of gold mining acquired by reading one book en route to the mine. This may be an extreme case, and undoubtedly is, but it merely illustrates the general idea that any one is competent to report on a mine.

We have in mind another pseudo expert, who recently armed himself with an immense revolver, a bottle of snake antidote, and a government report on the Indians of the Southwest, and started off to do his own experting on a copper mine in Arizona.

As usual, he was led to discover our old friend, the true fissure vein, and a minute investigation of a 200-foot hole, called a shaft, convinced him that the values went down, and not up. After cracking rocks all along the 30-foot outcrop easily followed over the desert for a mile, he was convinced that a 200-ton mill would never be able to mill all the ore right in plain sight—and in this some one made the mistake of telling him the truth.

Our precocious friend having seen all there was to see, thereupon backed up his convictions with his spare cash and invested in some lurid curiosities in the shape of stock certificates. But in the course of his missionary work among his friends at home, he encountered a "Man from Missouri" who had to be shown. So a certain mine expert travelled all the way to Arizona to see the greatest copper mine in the world—much to the wiseacre's disgust at the useless expense. Much to his surprise the expert found that our friend was perfectly correct in his report—only he had overlooked one little detail. The immense ledge truly did carry millions of tons of copper ore in plain sight—only it will take several geological epochs to make it available for human needs, for, sad to relate, this ore was simply chrysocolla, or silicate of copper, which can neither be smelted, concentrated, nor leached to recover its copper, and is about as valuable to the copper industry as if located upon the wide expanse of the moon.

And thus we sigh in resignation as we record one more failure of the man who does not require the services of a mine expert.

A CONFLICT OF OPINION.

The old adage "Many men, many minds" was never better illustrated than it has been in Cobalt recently. The New Ontario Mining Act is the disturbing cause. Unfortunately there seems to be an inclination to make this a party question—something that would be much to be deplored. Let us, as far as possible, keep mining and politics distinct.

Elsewhere in the present issue will be found a long contribution by a special correspondent, Mr. Wm. A. Laycock. Mr. Laycock has very strong views on this subject, and there are many who think with him; on the other hand, there are a large number who are not inclined to see things in the same light.

The *Haileyburian*, which is published within a few miles of the focus of disturbance, and which is an independent organ, with a leaning toward the Government, has the following to say about the recent meeting:—

"We were present at the supposedly representative meeting of the miners and prospectors, at Haileybury, and we have rarely taken so much fun out of folly as we did on that night. The hall was crowded, and after listening to a lot of eloquence, which a bystander characterized as hot air, a motion was put, practically endorsing a vote of confidence in the present Government. The Chairman pronounced the motion carried, though there was not a ten per cent. showing of hands in favor of it.

"We saw one resolution put through on the strength of an innocent hand being raised by a man who knew not what he did, and, afterwards would repent in the misery of a minority, which we have often done ourself.

"As a general expression of public opinion the whole results of that meeting can be discounted, though delegates have been appointed to go down to Toronto, to interview a tired Government. Some threatened that they would be retired, but we hardly think so, and will cheerfully bring on the fight, any time that they want it."

Mr. J. H. Warner, M.E., a mine owner, also agrees that the discontent is practically limited to unsuccessful prospectors, and is of the opinion that the new law is not in need of amendment. On the other hand, Mr. F. Wallace White, of Cleveland, U.S.A., who is represented to have "a syndicate" behind him representing enormous wealth, says some very unkind things about the new enactment. He states that he has been twenty or thirty years in the mining business—a few years more or less do not, of course, matter—and is very sure that the law as it stands is impracticable, unreasonable, unjust and unwarrantable. This statement seems to about cover the ground. We believe the matter is to be threshed out in a few days in Toronto, a special meeting of the Government having been convened to consider the question, but unfortunately the Review will have gone to press before that important meeting is held, so that we cannot say just what will be done. In such cases as this it is always well to hope for the best and prepare for the worst —and this is the only advice we can offer our friends.

HIGH WATER MARK.

The large flotation now being attempted in New York, Boston, Montreal and Toronto, under the name of the "Nipissing Mines Company," was originally a comparatively humble undertaking. One E. P. Earle, an ore and metal broker of New York city, to whose attention the ore from Coleman Township, Ont., had been called, visited the township late in the autumn of 1904, and subsequently, for himself and some members of the International Nickel Co., acquired some six or seven tracts of mineral land, aggregating 846 acres, and organized a corporation under Dominion laws with a (comparatively) modest capital.

At this time (Jan.-July, 1905), all ores sent out from the new region went to Ledoux & Co. to be sampled and were then sold to Mr. E. P. Earle for account of the Nickel Trust. It will be distinctly remembered by many of the mine owners at Cobalt that, when the production from that camp began to threaten to swamp the market for Cobalt ore, that first pay for arsenic was refused, then payment for Cobalt in the ore began to steadily decline (from 80c per lb. to 30c) until finally no payment was made for either Cobalt nickel or arsenic; with the climax coming last December when the owners of mines in the Cobalt region (with the exception of the Nipissing and one other) decided to sell no ore to the Nickel Trust, but to undertake the smelting of their ore themselves. The result of which is the North American Cobalt Co. and the Experimental Smelter at Hamilton, Ont.

It will also be remembered by Messrs. Trethewey, Timming and others that officials of the International Nickel Company then found it quite convenient to repudiate any connection whatever with Mr. Earle, who was represented by these officials to be merely an ore broker whom they sometimes had occasion to use.

These remembrances are forcibly called to mind by the list of directors of this new "Nipissing Mines Company," Capt. De Lamar, E. C. Converse, Col. R. M. Thompson and Ambrose Monell ! ! Verily! in those days was there more truth in the mouth of E. P. Earle than in the International Nickel Co. But, to criticise the flotation, it seems clear to the Review that to expect reasonable dividends on $12,000,000 of capital and also a return of the original investment, which must occur in any legitimate mining venture, is to expect an improbability, from what is at present known of the district.

The point in favor of the large capital is the very large area of some 846 acres owned by the corporation; the main points against it are, the known fact that at least four of the "veins" have completely disappeared at a depth of forty feet or less, and the experience of several of the deposits that increased depth has been accompanied by diminished values.

THE TASK OF THE GEOLOGIST.

We have our full proportion of the educated, yet it is undeniable that the average Canadian—the man on the street—has but slight conception of the usefulness of a geological survey. We believe that it was once the proud boast of a certain Cabinet Minister that he had never set foot within the Geological Survey Building during all the years he had been at Ottawa. But a little thought will show any intelligent man that the Geological Survey is capable of rendering the country a very great service. It is not necessary that the trained geologist should himself discover valuable deposits of mineral. For every vein that is worth the working there is many a square mile of barren rock, and the geologist is too busy upon the purely scientific side of his task to have much leisure for digging and delving in the hope of discovering some rich vein. His task is to show to the uneducated prospector the areas wherein the latter should work. He can say such and such a district is promising for coal, or gold, or copper or what not, and then the prospector can get to work intelligently, and without losing some of the short open season in prospecting ground that never could, in all human probability, repay his efforts. And this is but one of the services the trained men of the Geological Survey can render.

No doubt the Survey itself has been to blame, insomuch as it has been rather too much inclined to hide its light under a bushel. The man of science is not always the man of business. The active, energetic fellow with a commercial mind is very shy of reading scientific reports, especially if they bristle with chemical formulae, whereas the geologist fairly revels in such things. Only the other day our valued contemporary, *The Mining and Scientific Press,* alluded to the terribly perplexing phraseology adopted by a commission that has just finished its labors in California. This commission was appointed in hot haste by the Governor of the State to report upon the recent earthquake. The information it was to gather and impart was to be for the benefit of the average Californian citizen. Yet, when this report—admirable in all other respects—issued from the press, it was found to be so terribly abstruse that nine out of ten men could not understand what it was all about. We think that there has been a little too much of this sort of thing with our Geological Survey reports, but we feel sure that in future they will not be open to this reproach.

Not many weeks ago the American scientific press hailed with delight a "discovery" that had been made in connection with corundum by a United States geological expert. The "discovery" had, however, been made and reported on two years previously by our own Survey, but it had been hidden in an unwholesomely dry-looking blue book, which, we are pretty sure, was chucked straight into the waste-paper basket by most of those who received it.

Whatever may have been the views of the several past directors of the Survey, from Logan to the present time, it is quite evident that the lately appointed director, Mr. A. P. Low, has no intention of allowing the useful work being done by his officers to escape the notice of the public. The press of Canada is kept posted—and in a way that requires of its readers no special scientific attainments—with any work done by the Survey that is likely to be of general or economic interest. In future, no mining man will have an excuse for not studying all the data available concerning the district in which he is working, or which he intends to prospect. It will be very strange if he cannot find in the voluminous reports of our Survey some useful hints, or some statement that may save him both time and money. Any bona fide applicant has only to write to the Survey for any published report in which he is personally interested, and we understand he will receive the same by return post, free of charge.

THE EVA MINE.

By Alfred W. Dyer.

Two facts in connection with the recent successes of the Eva mine in the Lardeau, to which so much attention has recently been given in the press, come out saliently; the one being that it is possible in a country with as yet inadequate railway facilities and where top prices are paid for labor, to make a thirty-five per cent. profit out of six-dollar free milling gold ore, even when run on a development basis. The other that it is possible for enterprising men, even when only backed by small capital, to make a Kootenay mine pay from the grass roots, for the Eva has been developed with the profits of development.

As a result of six years deliberately persevering work, in varying fortune, the Eva Gold Mines have 200,000 tons of $6.00 rock in sight, seven tunnels, giving a depth of 800 vertical feet and measuring over 5,000 feet lineally, two tramways of a joint length of over a mile, a flume over 4,000 feet long, a mill and concentrator sufficient to handle 1,000 tons of ore monthly, the usual equipment of tools and buildings, and are making a profit of $1,500 a month, turning out regularly each month a gold brick valued at over $5,000, and all on a development basis. Now the Eva is contemplating a different system. There are two courses open to the mine, the one being to use the present profits in putting in a power drill compressor, a cyanide plant to treat its own concentrates, and so, possibly, to double almost immediately the profits and put them into the larger scheme. This is to invest capital, open up the mine to a depth of another 1,000 feet by driving a tunnel, 3,800 feet in length, increase the proposed power drill and also the mill, and so handle double as much weekly as is now being done monthly and do so at a largely decreased expense. One of the two schemes will be definitely entered upon before this meets the eye of the readers of the Mining Review.

The Eva mine, which is situated on Fish Creek, five miles above its fall into the north arm of Upper Arrow Lake, lies 2,000 feet vertically above the

Flume Bringing Water to Eva Mill.

Glory Hole on Blow Out.

The Eva Mill.

town of Camborne, where the mill is situated. Its geological characteristics are peculiar. R. W. Brock, of the Dominion Geological Survey, terms the country rock, north and south of the two fault planes of the mine, spotted phyllites. It is called in the district merely schist. The two fault planes are true fissures, two to five feet wide. They lie roughly parallel on the property, 100 to 175 feet apart, and can be traced on the surface for several thousand feet outside of the 2,000 lying on the possessions of the company itself. They comprise the same mineral belt on which occur the mines at Ferguson, the Nettie L., Silver Cup and others. Between the two planes are lying masses of ore, lenticular and irregular, ranging anywhere from twenty to seventy feet in width, and which are dyke matter, an altered diabase schist. The value of this ore runs about six dollars per ton.

The slope of the hill at the face of the workings is about thirty-three degrees. The highest working is two thousand feet above the mill and the lowest 1,200. All work is done by tunnel, with upraises connecting. Three glory holes, or surface quarries, have been started, one of which is being quarried sixty feet across. The upper working is connected with the lower by a tramway 1,300 feet long. The ore is fed automatically into the second tramway, 4,800 feet long, connecting with the mill below. The upper tramway is two bucket; the lower, a double rope, of the usual Riblet type.

Descending the hill, the ore is fed automatically and directly over a grizzley, 1½ inch aperture, into the ore bins. From the grizzley it passes directly into a Comet B, gyrating rock crusher, and thence through two Challenge feeders, the feed of a size to pass through a 1½ inch ring, into two batteries, each of five stamps. Here water is added, and from time to time quicksilver, the amalgam being cleaned up once a month from the mortars. The pulp then passes over ten-feet copper amalgam plates, where forty per cent. of the recovery is made, to hydraulic classifiers, four in number, each of which supplies a concentrator consisting of a Wilfley table with set and water adjusted, to the classification, and through three six-feet Frue vanners. Here are accumulated the concentrates, chiefly iron pyrites, running from one to two per cent. of the tonnage treated. This is sent periodically to the smelters, where a favorable rate is obtained because of the iron pyrites having value as a flux, running thirty per cent. with an excess in units over silica contents. The value of the concentrates averages $26.00 per ton. Freight to the nearest shipping point, Beaton, and freight thence plus smelter charges runs up the cost of further treatment to about $13.00 a ton. With the installation of a small cyanide plant, to be put in this summer, the treatment will be cut to $3.00 to $5.00 per ton, allowing a further sensible margin of profit. The value of the ore when fed is a few cents over $6.00. The recovery is $5.20.

The mill is designed for forty stamps, with power and machinery so arranged, but the mill at present has only ten stamps which will be immediately added to. The power is got by means of a flume from Pool Creek, which manager Gracey reports has never had less than 1,800 miners inches at its lowest stage when examined, and on which the company possess a record of 700 inches but are hardly using fifty at the present. The flume is 4,000 feet long, and as it had to be blasted out of a precipitous rock face for much of the way, it cost $10,000 with the pipe line. Were the mill enlarged to its capacity it would use about 228 horse power. Three Pelton water wheels now supply power for crushers, tables, vanners and batteries.

The total costs of mining and treatment from Jan. 1, 1905, since when the mill has been running continuously, have averaged $3.84 per ton. These the manager's recent report gives as follows:—

Mining	$1.45
Development	1.37
Tramming	.16
Milling	.62
Superintendence and general	.24
Total	$3.84

Lately these costs have run down as low as $3.60 and were never higher than $3.95. The relative costs of mining and development, as most of the ore has been taken out in development, are difficult to ascertain, and have been adjusted by allowing for the cost of drifting.

These results have been obtained by the work done, work largely in the nature of a test, with a ten-stamp mill. But bringing the mill up to a forty-stamp basis, the costs are expected to be:—

Mining	$1.06
Tramming	.09
Milling	.32
Superintendence and general	.15
	$1.62

Development work would be in proportion to the amount of tonnage desired. Without any further development, it would be possible to run the mill, increased to forty stamps, for the next four years. But if the larger scheme be decided upon, the output of the mine could be doubled even on this estimate and the output maintained for a large term of years before sinking would be necessary.

Manager Gracey gives as reasons for the exceptionally low costs the fact that the ore can be mined for a depth of 1,800 feet without sinking, the ample water power, the system of handling the ore from the rock face to the tailings by gravity alone, that many thousands of tons can be quarried from the glory holes, and from the plentiful supply of timber.

Looking Down Thibert Creek from Junction of Berry Creek.

Berry Creek Mining Co.—Showing Strata of Gravel in Bank.

MINING IN NORTHERN B.C.

The last general report of the Berry Creek Mining Company, Limited, of Victoria, B.C., by its manager, Mr. Alex. Hamfield, throws a good deal of light upon the conditions that exist in the extreme northern portion of British Columbia. The mine is situated in the Cassiar mining division, and is reached by way of Fort Wrangel, Alaska, and Telegraph Creek, B.C. From Telegraph Creek a pack trail, 72 miles long, is followed to Dease Lake. There the traveller embarks and goes by water to Porter's Landing, 26 miles distant. From this point a pack trail 8 miles long exists to the mine. The mine is 3,000 feet above sea level.

The Cassiar District was discovered in 1873, and produced in a few years about five million dollars in placer gold, three creeks, Dease, Thibert and McDames, being the heaviest producers, and about one-third coming out of Thibert Creek.

After this no work was carried on, except by a few Chinamen in a desultory way, until the Berry Creek Company undertook to prospect and open up Thibert Creek.

The Company is the owner of ten hydraulic leases, each 800 acres, in one continuous body fronting Thibert Creek for 15,000 feet. The title to this ground is held by lease from the British Columbia Government. The mine is situated on an ancient river channel, probably pre-glacial, on the south side of Thibert Creek, following the same general direction as the latter, from west to east, and is of similar nature to the channels in Cariboo, Atlin and Yukon. The general formation is schist, making a favorable bedrock for retaining the gold, the latter occurring from the size of nuggets to very fine, some being almost invisible, and its existence having only become known through assays of concentrates, but the greater portion is of the size of small shot and is easily caught in the sluices. The principal part of it is found in the gravel on bedrock, although some also occurs through certain layers in the upper part of the deposit. The deposit shows the unmistakable river strata; first heavy gravel with boulders, then lighter gravel, then clay and sand, and lastly again finer gravel.

It is difficult to correctly estimate the size of a deposit of this nature as the width varies from 300 to 600 feet, and the height from 50 to 200 feet.

Estimators put the average width at 350 feet, the height at 125 feet, and the length at 15,000 feet. This will give on the Company's properties an estimated gravel deposit of about 30,000,000 cubic yards of gravel, of which not more than between 400,000 and 450,000 cubic yards have been washed by the Company, and perhaps 100,000 cubic yards by former miners.

Labor.

The scale of wages at the mine is as follows:—

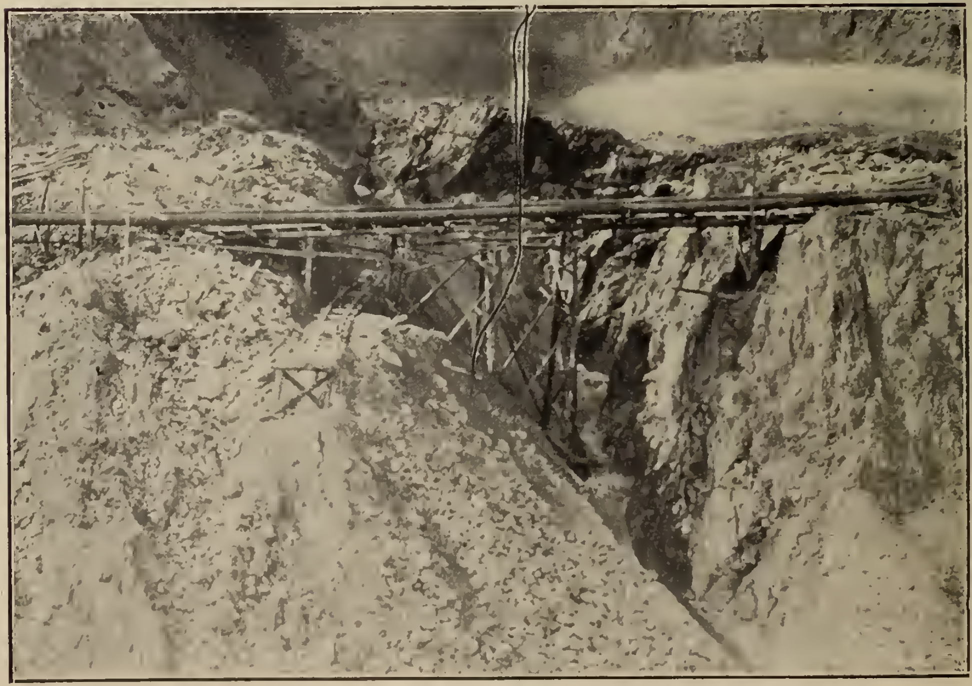
Foreman	$5.00
Pipers	4.50
Blacksmith	4.00
Carpenter	3.50
Laborers	3.00

to which must be added $1.25 per day for each man's board.

Men brought from Victoria receive 50 cents per day less than this scale, as the Company has to pay the cost of their transportation. The price of ordin-

Map of Thibert and Berry Creeks, Cassiar.

Berry Creek Mining Co.—Flume Conveying Water to Mine.

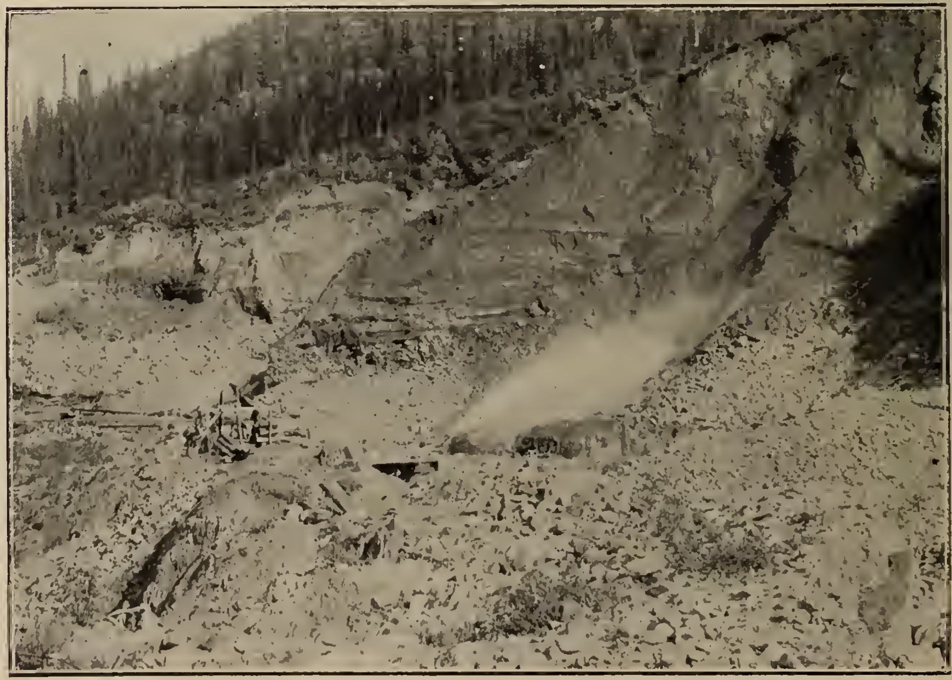


Berry Creek Mining Co.—Showing Dump of Washed Gravel.

Berry Creek Mining Co.—Mine Buildings on Thibert Creek.

Berry Creek Mining Co.'s Sawmill on Dease Lake.

Berry Creek Mining Co.—Showing Part of Mine with Two Giants Working.



Berry Creek Mining Co.—Showing No. 3 Pit with One Giant Working.

Berry Creek Mining Co.—Showing Mine with One Giant Working.

Berry Creek Mining Co.—Showing Position of Mine above Thibert Creek.

ary labor can probably be cheapened by hiring Japanese, or men from Eastern Canada. The Hudson's Bay Company has had the handling of the company's freight for the last three years at 11½ cents per lb. from Wrangel to the mine. This can probably be cheapened from 2 to 3 cents per lb. by the Berry Creek Company being prepared early in the season to enter into a fairly good sized contract.

Preparatory work on the mine commences sometime in April, and washing can often begin the 10th of May, and continue until about the 20th of October. If everything is in readiness for the spring work so that no time is lost, this will give from 150 to 160 days, 24 hours per day, for washing of gravel.

A NEW MATTING FURNACE.

By F. F. Coleman.

The National Metallurgical Company's smelter at Matehuala, Mexico, which was put into successful operation last year, is now being more than doubled in capacity. The additional furnace and equipment is being furnished by the Traylor Engineering Company of New York, who originally designed the plant.

The new furnace which forms the chief feature of the addition, was built at the Engineering Company's new works at Allentown, Pa. It was shipped to Mexico early in May. The furnace was set up complete at Allentown before shipment. A photograph made of it in the shops is reproduced herewith.

The furnace measures 42 inches in width and 160 inches in length inside the tuyeres. It has a capacity of 250-300 tons per day.

The ores treated are copper sulphides which are reduced to copper matte. The matte contains about 40 per cent. of copper. The new furnace is fitted with the Giroux Hot Blast Top, which has proved itself such a valuable fuel-saver at the United Verde Smelter at Jerome, Arizona, where the top was introduced by Mr. Giroux while he was in control of the operations of that plant. The Giroux Hot Blast Top is now controlled exclusively by the Traylor Engineering Company.

This device consists of two sets of air-heating pipes surrounding the upper part of the furnace within the brickwork and connected directly with the bustle pipe by means of a nipple at each end of the furnace. The upturned opening in the bustle pipe, shown in the illustration, forms this connection on the end of the furnace shown in the foreground. There is a similar connection at the other end of the furnace.

The Giroux Hot Blast Top for this furnace will heat the air for the blast to a temperature of about 400°F. Experience has shown that it effects a saving of 30 per cent. in coke, besides adding materially to the daily capacity of the furnace.

The entire furnace is self-contained. That is, it is entirely supported on the corner columns and jack screws so as to be independent of the building in every way.

The furnace is constructed with flange steel water jackets throughout. The jackets are made so that no rivet heads or riveted seams of any kind are exposed on the inside of furnace where they could cause trouble by leaking. The rivet heads and seams are all at the outside where if a leak should start it can be promptly noticed before it can give trouble and be remedied simply by caulking. The water pipe and bustle pipe are both on the outside of the blow pipes and about four feet from the jackets, so that in case it is desired to remove a jacket section the water pipes and blow pipes immediately in front of it may be taken off and the jacket removed without disturbing the balance of the air and water connections on the furnace. This cannot be done where the pipe is arranged on the inside of the blow pipes as is usually the case. The upper jackets are supported on an I-beam frame carried by brackets on each of the four corner columns. These are carried independently from the other portions of the furnace. All the jackets composing the lower set are fitted with lugs which are arranged to bolt to similar lugs on the bottom flange of the top jackets so that in case the furnace bottom plate is removed for the purpose of replacing the brick lining, or for any other reason, the set of lower jackets remains in place without disturbing any of the connections suspended from the upper jackets carried by the I-beam frame referred to. All joints are made with sufficient clearance and adjustment so as to avoid the close fitting which is the cause of so much trouble in the average furnace construction. The lower jackets are all made so that any sediment which may collect in them is deposited at the bottom of the jackets. This is below the zone of intense heat and, therefore, will not endanger the jacket sheets. The joints between the blow pipes, tuyeres, and jackets are arranged with recesses and provided with round asbestos packing held by clamp draw-bolts. This affords tight joints and, at the same time, permits of a certain amount of flexibility which is necessary to avoid the danger of straining the joints and causing leakage when the furnace expands or contracts from the heat during operation. There is no brick work required for lining the furnace below the feed floor except the small amount immediately over the furnace bottom plate. The furnace is tied securely at the sides with an I-beam frame having end draw bolts. This feature does not show plainly in the cut. The waste water discharge from the gutter passes down through two outlet pipes into the central opening of the two rear furnace columns. These are furnished with a tap flange at their base which, when the furnace is erected, is below the ground floor, and from there may be connected by pipe to a drain.

Giroux Hot Blast Top, Copper Matting Furnace.

A COMPARISON OF THE COBALT AND SUDBURY MINING DISTRICTS.

Editor Canadian Mining Review:—

Now that the Magmatic Segregationists have completed their rainbow around the Sudbury district and provided for the leaks which resulted in all the ore bodies that do not conform to their theory, the nonconformists, heretics, and others in outer darkness may have a few things to say on what "might have been," if things are not just as they say they are. If for no other reason I would as a taxpayer object to the waste of public money in printing and distributing at public expense such a mass of misinformation as is contained in the Report of the Ontario Bureau of Mines regarding the origin of the Sudbury ore deposits. There is much in the report of a geographical and historical nature that has been printed in other publications which is probably accurate. The theoretical interpretation of the geological conditions continues year after year with the same monotonous regularity, to force upon the unresisting public the mistaken magmatic, fusion, acid, and basic edge, differentiation theory that has become tiresome.

There is only one point to determine what will disprove all that the Canadian Geological Survey and the Ontario Bureau of Mines and the people whom they imitated, have said on this subject. That point is simply "Is the greenstone which they call by several different names an overflow on top of the sediments or is it the infolded basement rock on which the sediments were laid down?" I claim that it can be proven to any competent observer that the latter is the truth and, therefore, the ore bodies which occur on the contacts between the folds of greenstone and sediments are of hydrothermal replacement origin.

There are miles of contact without ore bodies or signs of mineralization, and there are also dozens of contacts that are not shown on the maps issued by the departments referred to. They have painted in the geology as being of a certain character, where subsequent observations have proven it to be of an entirely different character, and it is no exaggeration to say that a more misleading and mistaken source of information could not be found than their reports and maps, which should be correct. It is of no use to try at this late date to convince them that they are wrong in theory, or as regards their maps, but it is worth while to protest against the acceptance of their reports by others who have not the opportunity to make observations.

I have taken every opportunity to combat the acceptance of their teachings and I now wish to challenge the Director of the Geological Survey and the Minister of Mines of Ontario to come here as my guests to see the conditions which will prove my contention, that the greenstone is the infolded basement rock on which the Huronian Series was laid down. With that one point proven the whole magmatic segregation theory is swept out of existence as regards these ore bodies.

I will also extend this invitation to Dr. Frank Adams, of McGill, and Mr. John E. Hardman, M.E., of Montreal.

The mining industry has had to stand for so much theorizing by office observers that I think such a committee would be well worth the while and do much toward arriving at the truth. The sulphur gases from the smelter and roastyard have killed the vegetation along the tramway and there is no better place in the district to get an ideal cross-section of the geology and observe the folding. My observations at Cobalt convince me that the same general conditions prevail there. The igneous rock, which is called by different names in different parts of the district, is the basement rock on which the Huronian series and all the later sediments were laid down. Subsequent folding has caused these rocks to be thrown into wave-like forms and the synclinals of these folds are now occupied by a chain of lakes parallel to Lake Temiskaming in the majority of cases.

Cross-folding is also in evidence and this has resulted in a series of folds the synclinals of which are occupied by lakes at right angles to Lake Temiskaming, which is also a synclinal fold. The veins are fractures radiating from contacts exposed by glaciation. The folding has not been as great as in the Sudbury region where the sediments are standing on edge.

The fact that the veins contain silver was determined by the source of the magmatic waters containing that metal, and has no bearing on the method of deposition, which in all such veins has been due to highly heated solutions coming from great depth through small fractures along planes of movement in process of folding. The folding is also due to the escape of magmatic waters and the reduction of interior pressure.

The constant reduction of the earth's diameter due to the escape of these magmatic waters through hot springs, geysers, and volcanoes results in the cold crust being thrown into great folds which grow into mountain ranges. Along these folds new openings are made and magmatic steam under enormous pressure and temperature rushes out, bringing with it in solution the sulphides which are deposited in the fractures near the surface, and make veins and ore bodies about the origin of which men calling themselves geologists get all balled up.

A debt of gratitude is due to the discoverer of the true source of magmatic waters, be he Arthenius (Swiss), or any other, but now that we recognize that the waters issuing from hot springs, geysers, and volcanoes are distinct additions to surface waters, it is easy to explain many things that previously were enigmas.

HIRAM W. HIXON.

Victoria Mines.

THE DAIGLE MINE.

By W. A. Laycock.

Even as late as the fall of 1905 a trip from Cobalt or Haileybury into the extreme south east corner of Coleman Township, would have entailed some hours of laborious effort, while only the most sanguine prospector would have dared to suggest a reasonable amount of hope that valuable discoveries would be made. Now, the conditions are changed in every way, and not only may the wayfarer travel in comfort, but at the end of it all each may see discoveries of ore sufficiently rich and interesting to please the most exacting.

The early morning train between Latchford and New Liskeard is usually well filled with passengers for stations between those two towns, stopping at Argentite to allow a typical mining camp crowd to reach the various points of activity in the Cross Lake. Lorrain and S. E. Coleman sections, by steamboat, or gasoline launch, which run every hour or less to any point required. Both the railroad and boat service is so excellent that many interested in these sections, live with their families in Haileybury or Cobalt, and make the journey back and forth each day.

Last month, on the day in question, a party of six, with the writer, visited the discovery known as the "Daigle" find. Wild, and apparently unjustifiable rumors of the length, breadth and richness of this ore body had been floating around the district for some weeks, growing more unreasonable as the description spread, much in the manner of the historical "Three black crows," and, naturally, we looked forward to something extraordinary at the end of our journey.

When the steamboat landed us at the head of Cross Lake, we found a good waggon road, and a walk of a mile and a quarter before us, up a steady slope and along well timbered ridges, and this—apart from the persistent attentions of numberless mosquitos and black flies—was most enjoyable, spiced as it was with the pleasures of anticipation.

On arrival we found roomy camps in course of erection, and then immediately turned our attention to the much-discussed vein.

Varying from a mere crack up to fourteen inches of ore the vein has a strike of almost due north and south, and by actual measurement has been traced for a distance of fourteen hundred and twenty feet, this, however, by no means represents the extent of the outcrop, systematic stripping having exposed it on further claims both to the north and the south. It has already proved to possess the greatest length of outcrop of any in the Cobalt district, and a well sustained report that it has been picked up by crosscut stripping a third of a mile further south, would suggest that one of the most important ore bodies in New Ontario has been discovered.

Perhaps one of the most interesting features, is that at one point where the outcrop is nothing more than an irregular crack, at less than six inches below the surface, over five inches of ore have been exposed. This can be distinctly seen in the illustration, immediately below the "+." This kind of occurrence is not singular in this district. one vein upon the Nipissing Mining Company's property carrying several inches of ore, comes to its apex some eight inches below the surface, upon which there is no sign of vein or even fissuring. Other instances could be cited of valuable ore bodies being opened up, when the surface indications of such were of the smallest.

In other places where the vein has been exposed by extensive stripping, the ore varies from four up to eighteen inches in width, and is shown to be well defined.

A shaft has been commenced at the south end of the property, and at ten feet in depth eleven inches of solid ore is being bagged for shipment, three tons of the same having been so treated in two days at the end of the month, and active development is quite the order of the day.

The greater amount of the ore exposed is quite characteristic of the district. Very little vein matter, which consists of white calcite, and in one small exposure—quartz—is present, the ground mass being smaltite or diarsenide of Cobalt, with high values in silver, very little of the latter, however, being visible, and the amount per ton was reached by assay, the lowest obtained in silver alone from an average sample showing no visible silver, being nineteen hundred and thirteen ounces per ton.

The surface of the ore body shows considerable evidences of the decomposition product of smaltite—Cobalt bloom—except where the ore has been removed by erosion or later weathering influences. In places the walls of the vein stand well defined for eighteen inches or more, without filling of any kind, above the outcrop of the ore as existing in place.

At one exposure where the vein is about eight inches wide chalcopyrite is present in massive form, co-mingled with smaltite in lesser quantity, and assays have shown the presence of gold to the extent of several dwts. to the ton.

Niccolite, cobaltite and native bismuth are also visible in places, but comparatively little of any of them have so far been exposed.

The geological formation in which this ore body exists is a matter of much discussion and dissension among mining men, and incidentally mining inspectors. One classifies the formation as of Keewatin origin, another denies the presence of the same, and asserts that rocks of the middle Huronian series are the principal ones in evidence, another that the slates of the Lower Huronian predominate! In the writer's opinion, the formation as exposed show rocks of the earlier origin, with an intrusion of gabbro, at both the northern and southern end of the property. In fact, the vein may be described in places as being a true fissure, and in another as a contact. It is almost impossible to determine any contacts at present, as but little of the country has been stripped systematically. About 250 feet from this vein, another calcite vein outcrops, and almost at right angle to the former a band of country rock about two feet wide, and mineralized in massive form with pyrites of iron and copper forms a connection between the two. This, however, does not in any way interfere with the continuity of either one or the other of the veins, but it is not known how far this pyrites deposit extends.

In reference to the calcite vein above referred to, a shaft has been sunk 35 feet, exposing an ore body about 12 inches in width, this carries good values in silver, and cobalt in the form of smaltite, chalcopyrite being present in small quantities. This was the original discovery upon which the property was "passed," and the rich vein before described was subsequently discovered as the result of stripping.

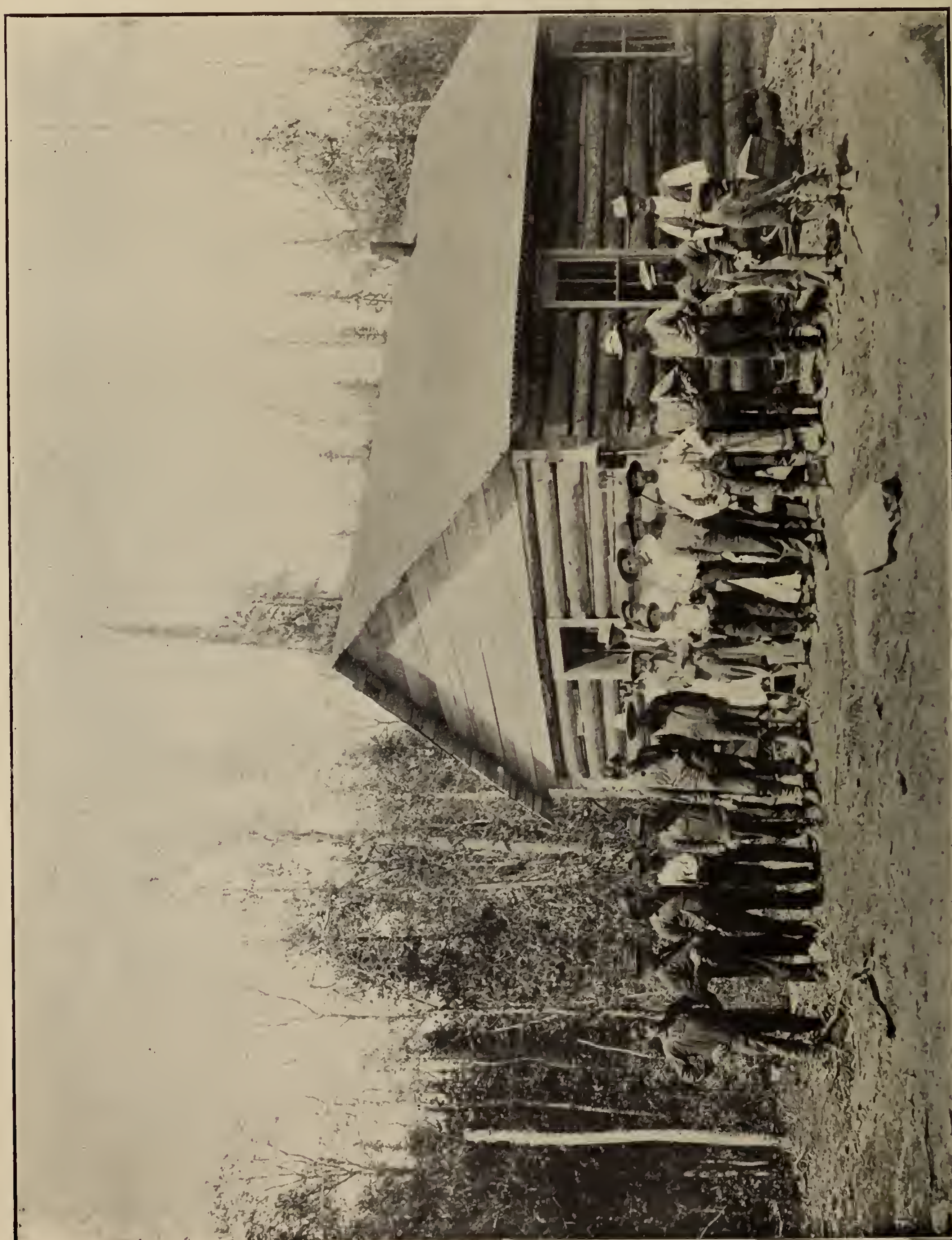
A quarter of a mile due southwest from the shaft on this vein, another discovery has been made of native silver and smaltite. The ore body is narrow where exposed, but values are good. The formation is gabbro.

In further proof of the fact that the characteristic ores of the Cobalt district have a greater distribution than was anticipated, two discoveries of importance have been recently made in Buckle Township, and two in Lorrain. In reference to the former, one is situated but little over a mile west of Argentite siding: a shaft was sunk on a stringer of calcite, carrying little mineral save chalcopyrite, and the surface indications were of the most unlikely description. Between forty and fifty feet in depth silver and smaltite were shown up, and the shaft at eighty feet is still exposing good values.

About four miles further north in the same township, a pit about ten feet in depth was sunk upon a stringer of hematite. At eight feet smaltite took the place of the former, showing also fair values in silver, and in one sample gold.

In the township of Lorrain two discoveries have been made of native silver on adjoining claims, and apparently upon the same vein, but little work has been done, and so far it is insufficient to form any decided opinion as to the ultimate merit of the deposit.

All the discoveries referred to are of importance apart from their respective merits, as proving that the silver-cobalt distribution is not confined to the compar-

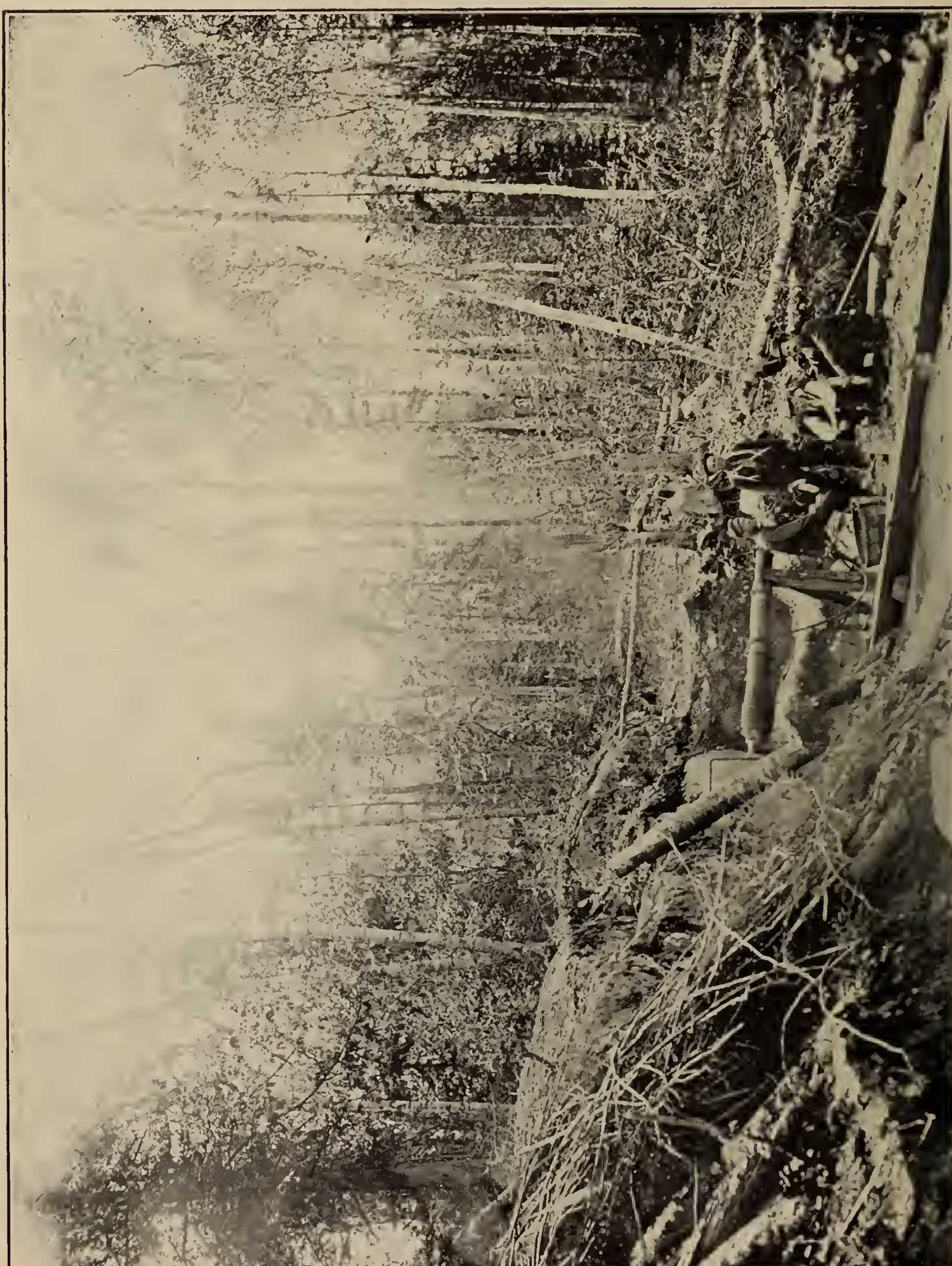


One of the Daigle Camps.

First Vein, stripped. Daigle Mine.

Vein widens at the point marked "+" from a mere crack on surface to several inches in width immediately below Daigle Mine.

Outcrop of vein on Daigle Discovery ; width 10 inches.



Shaft, now down 35 feet on Daigle vein.

atively small area originally discovered. All these discoveries, with the exception of one, are the result of work undertaken before the prospector had received title from the Government, by virtue of "inspection of discovery." Each and all of these discoveries either have been or will be undoubtedly passed, and encouragement will hence be given to those who intend to retain their identification with the district. The unfortunate condition of affairs which, however, exists is that many men of note in the mining world, representing knowledge and large amounts of capital have already left the country in sheer disgust at the chaos which reigns—principally in reference to title—as a result of the Mines Act, each and all agreeing that business under present circumstances is impossible.

The result of this depopulation of New Ontario, of the very men who are essential to its forging rapidly ahead, is that, while a few new discoveries will create local interest and benefit the individual, the large amounts of capital required to open up a new mining field will be kept out of the country, and Ontario (in the mining sense) become a by-word among the very people upon whom its success depends, for no reason other than the acts of its legislators.

The expressions of opinion at the meetings of miners held at Latchford, New Liskeard, Haileybury and Cobalt, during the last week in June, were sufficient in themselves to demonstrate to the Government that the present condition of affairs is intolerable. Every meeting except that held at Cobalt, was unanimous in its demand for the withdrawal of inspection of discovery, and security of title—and it is upon those two points that the battle is to be fought out.

It is agreed upon all hands that if title were to depend upon "work"—even if continuous for a reasonable period—instead of upon "discovery," miles of stripping, and hundreds of feet of underground prospecting would be done, which will never be attempted as conditions exist. The loss to the province and particularly to this portion of it, through this extension of development being withdrawn, is enormous in a business sense, apart from the possibility of numbers of valuable deposits being exposed, which recent events seem to justify.

Delegates drawn from the miners and prospectors are to meet Premier Whitney, it is hoped early in July, and their credentials will be in the form of a petition stating their demands and bearing the signatures—it is anticipated at the time of writing,—of over two thousand mining and business men. It is sincerely to be hoped that the Government in this case will not turn a smiling face and a deaf ear, as they have done heretofore to both petitions and the findings of the mining convention—which latter was of their own creating.

ROSSLAND MINING.

By Alfred W. Dyer.

The mining industry has shown much progress, and this is notably the case in Rossland, in the Boundary and, also, among the smelters. Rossland, in particular, is showing up very well. There are over nine hundred men employed at the mines, and, in addition, there are 550 men at Trail engaged in smelting the ore coming from Rossland camp and from the lead camps of East Kootenay and of the Slocan. Such economies have recently been effected that it is no longer held in Rossland that the day of concentration cannot be postponed. Indeed, the opposite idea now prevails. It is true that the late manager of the Centre Star-War Eagle properties declared that the mines of Rossland could not go on without concentration, but subsequent events show that the $300,000 concentrator built by Mr. Kirby at Trail, is abandoned and the ore instead of being shipped at the rate of 300 tons a day from his mines is to be shipped at 1,000. It is maintained that the experience of water concentration has shown that the recoveries are only 55 to 60 per cent. This, your correspondent declared some time ago to be the case, but a far higher percentage was claimed, and several concentrators were built upon the strength of these exaggerated estimates. It is true that the oil process will give a better recovery, but as it seems that the oil process cannot hope to save one dollar in the ore whatever the grade, then it follows that the lower the grade the greater is the percentage of loss, even if only one dollar. One dollar in $8.00 ore is but 12½ per cent., but one dollar in $5.00 ore is 20 per cent. This is better than water but it is more expensive, and, unfortunately, the Elmore people have never seen the necessity of putting up a mill of their own or at least seeing that their trial mills were connected with a mine which had a plentiful supply of concentrating ore of a grade about $6.00 to $7.00. This the Le Roi No. 2 did not have, and neither did the White Bear. Hence the process is looked upon with suspicion despite several years of more or less perfunctory trial. Again if the ore to be treated is $8.00 ore, even if it were $7.00, under the present methods of smelting with freight and treatment down to $3.50 per ton, which may yet be lowered, a profit can be made by direct smelting. Hence concentration in Rossland camp has had a set back.

But improved methods of smelting are of little avail if the ore bodies are not present, and it was declared, for the "'steenth time" in the history of the camp, that the bottom had dropped out of the Rossland mines. Now, it is true that, as the mines have gained in depth the copper values have decreased, but, on the other hand, the gold values are steady, and the sulphur percentage has so far decreased that at Trail it is now the practice to charge the furnaces with raw ore instead of first roasting it. This has saved one handling, and partly explains the cut in smelter rates.

Yet two great discoveries have recently been made upon the Rossland mines. The first occurred on the War Eagle. The main vein apparently squeezed out at the seventh level, and persistent exploratory work proved unavailing. The new management has discovered that the "squeezing out" was merely a flattening on the dip, and the ore body is now found to be good down to the 13th level. Besides this it must be remembered that the War Eagle vein is but one of a system of what is now known to be seven parallel veins at least, running east and west from the south Centre Star vein to the north vein of the Red Mountain, all belonging to this fine property. Not only this, but it is found that there does not exist an open stope in the mine, but which has ore which is of shipping grade. These minor discoveries are partly due to persistent development, and partly to the fact that ore which was formerly left unstoped is now, owing to cheaper methods of extraction and reduction worth winning.

And what is true of the War Eagle-Centre Star is also true of the Le Roi. Similar minor discoveries are also there playing an important part. But over and above this ore has been discovered west of the great dyke which was supposed to have shut off all mining in that direction. This has not only improved the prospects of the Le Roi, but also of those properties which lie west upon the vein. It would now seem probable that the great ore shoot will be found upon the White Bear, California, Evening, Eureka or even upon claims further to the west. It is now claimed that upon the three chief mines of the camp, the Le Roi, Centre Star and War Eagle, there are over 1,000,000 tons of ore in sight. That is to say there is enough for shipments at the normal rate for the next two or three years.

In the Boundary country preparations are being made to exploit the chief mines upon a larger scale, and, moreover, along the North Fork of the Kettle River activity is greater than had yet been witnessed in that district. The smelters are being enlarged, the B.C. Copper starting this month and the Dominion Copper soon to follow. The greater the tonnage handled, the cheaper the smelting, and the greater the quantity of ore available; a cycle that promises to make the Kootenays and Yale yet more flourishing and famous.

Looking at the copper-gold side of mining in this province all seems rosy, but such is not the case, despite the bounty, in lead-silver mining. Here, the smelters complain that they cannot get the tonnage, and some pessimists openly declare that it is not to be had. This is foolish.

There is plenty. The Trail smelter has greatly increased the capacity of its lead side. So has the Hall Mines smelter. Pilot Day has recently restarted, and there is Marysville. Four smelters where not long ago there was but one!

TEACHING GEOLOGY.

The Michigan College of Mines is required by law to make and keep a collection of rocks of Michigan. Such a collection has been in process of formation for many years, and now the College has decided to make this work of the widest possible usefulness to the people of the State. In order to do this in a most practical manner, the College of Mines has undertaken to make up a number of subordinate collections or sets of minerals which shall contain a series of the more typical rocks and minerals of the State. These loan sets, which consist of thirty-eight minerals and sixty-seven rocks, are being distributed through the State, and in addition each set is furnished with one copy of notes on "Rocks and Minerals of Michigan," issued from the Department of Geology of the College of Mines. These sets are lent to the different schools upon application from the superintendent or principal, and after being retained a certain time they must be passed on to some other applicant. Prof. A. E. Seaman, head of the Department of Geology, has taken an enthusiastic interest in the scheme and to him and Dr. Fred. E. Wright, formerly instructor in petrography, (but now on the staff of the United States Geological Survey), must credit be ascribed for what is evidently destined to be a most successful and popular departure.

THE HANCOCK JIG IN THE MISSOURI LEAD AND ZINC DISTRICT.

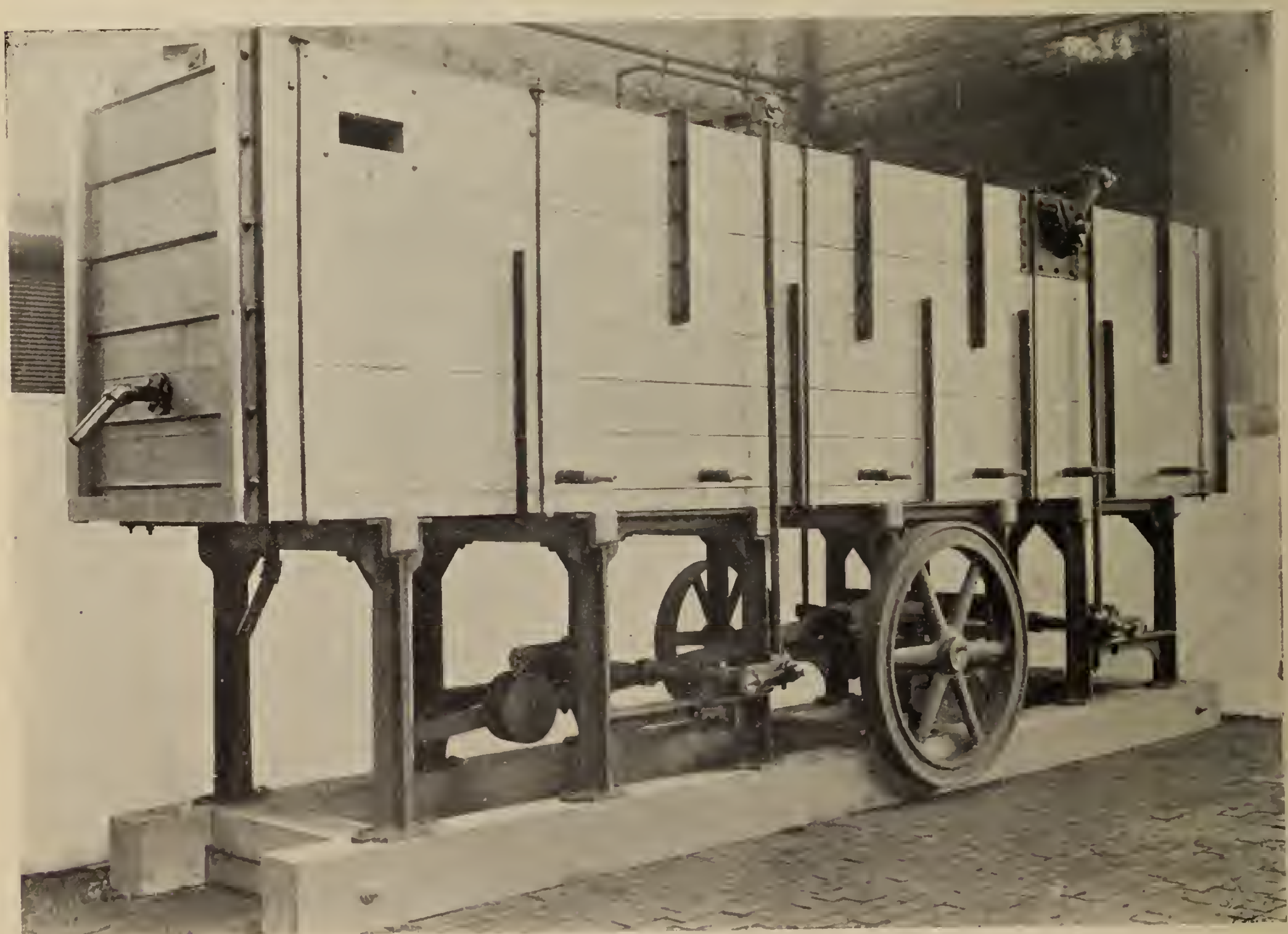
For the purpose of practically doubling the present capacity of its plant, the Wheeling Milling Company, controlled by Wheeling, W. Va., and Bellaire, Ohio, capital, and at the present time working over Mine La Motte tailings dumps, Mine La Motte Station, Mo., has purchased a 25 ft. Hancock Jig complete, from the Allis-Chalmers Company, Milwaukee, Wis., represented in Canada by Allis-Chalmers-Bullock, Limited, Montreal, Que.

The company has an equipment consisting of four 36 in. x 16 in. crushing rolls, concentration tables and jigs, having a capacity of about 300 tons. By the addition of the Hancock Jig, this capacity will be practically doubled, without the necessity of adding to the present power plant or water supply.

The Hancock Jig is of Australian origin and designed particularly for the treatment of low grade ores. It is the invention of Mr. H. R. Hancock, who, on assuming control of the Wallaroo Mines, South Australia, found great heaps of low grade ores on the surface. This ore was considered too refractory for any method of water concentration. He at once installed his jigs and converted these so-called waste heaps into a valuable asset.

The special features of this machine are: A very small amount of power to operate a very large production, ability to handle an unsized feed, requires 50 per cent. less water than the ordinary plunger jig. The Hancock Jig, because of its marked advantages over other kinds, has come rapidly into favor in the various mining industries of this country. This type of jig is proving especially valuable in the zinc and lead mines in Missouri and Wisconsin.

The St. Joseph Lead Company of Boone, Terre, Mo., will also install a standard 25 ft. Hancock Jig.



A Hancock Jig.

THE NORTH AND ITS GOLD.

The reported discovery of a rich deposit of free milling gold in Northern Quebec beyond the height of land tends to confirm the prevailing impression as to the mineral wealth of that region and will, no doubt, have the effect of hastening its opening up, writes the editor of the Quebec "Daily Telegraph." Should the find turn out to be anything as important as foreshadowed, we may expect at once a rush of prospectors and miners into the district, the majority of whom will, doubtless, make their way into it with their supplies via the Ontario Government's railway to Cobalt, from which place it is said to be not very distant. The sister province, and Toronto especially, will thus get the benefit of what, properly speaking, belongs to Quebec. This emphasizes once more the urgency of pushing a railway of our own into the James' Bay country without further delay, for, if we are not greatly mistaken, this is not the only valuable discovery of the precious metals that is going to be made there. We have still a vivid recollection of a lecture on Hudson Bay delivered a good many years ago in the old National School Hall on the Esplanade hill, by Dr. Bell, of the Geological Survey, in the course of which he indulged in the prediction that some day gold would be found in plenty in certain parts of that region which he indicated at the time. Since then, Hudson Bay Company factors and trappers have repeatedly reported pieces of native gold in the possession of local Indians, which appeared to have been cut or picked out of the rock with a knife, and which the Indians declared that they had found in the course of their wanderings or hunting expeditions in the region. The alleged discovery now there of free milling gold, that is to say, of the pure metal plainly visible in the shape of specks or lumps in the quartz or encasing rock, would tend to bear out the truth of their statement.

GERMAN CONSUMPTION OF COPPER.

Messrs. L. Vogelstein & Co., New York, state that the German consumption of foreign copper for the months January-April, 1906, as compared with the same period of time for 1905 and 1904 was as follows:—

	1906.	1905.	1904.
Imports	42,946 tons.	32,172 tons.	40,859 tons.
Exports	4,142 "	4,413 "	2,651 "
Consumption	38,804 tons.	27,759 tons.	38,208 tons.

During the month of April, 10,821 tons were imported into Germany, of which 9,350 tons were shipped from the United States.

NOVA SCOTIA MINING.

The following gold mining areas were applied for under lease and license during May, 1906:—

District.	Areas.	District.	Areas.
West Grand Lake	33	Lawrencetown	7
Broad River	18	Shiers' Point	24
Montague	18	West River Sheet Harbour	31
Oldham	2	Near Enfield	12
Somerset	72	Stormont	6
Renfrew	12	South Tremont	6
Millers Lake	24	Carleton	22
Preston Road	10	Gold River	35
East Rawdon	50	Voglers' Cove	6
Fifteen Mile Stream	42	Head of Chezzettcook	6
Cranberry Head	12	Whiteburn	12
Cape Porcupine	56		

Returns of Nova Scotia crushings during May show:—

	Tons.	—Yield— oz.	dwt.	grs.
G. & K. Gold Mining Company Mill, Caribou	2,939	383	6	0
J. A. Crease Mill, Uniacke	11	29	12	0

MINING IN BRITISH COLUMBIA.

(Continued from the June issue.)

There has been produced in the province in 1905 some 56,580,703 lbs. of lead, valued at $2,399,022, an increase over the preceding year of 19,934,459 lbs., or about 54 per cent. This year's lead production, with the exception of that of 1900, is the greatest ever made by the province.

It is noticeable that almost the entire output of lead is now from the Fort Steele district, while the production of the Slocan is only about half what it was the previous year, and one-third of the amount produced in 1901.

The following table shows the percentage of the total output obtained in the various districts:—

Fort Steele Mining Division	86.1 p.c.
Slocan " "	9.2
Nelson " "	2.5
Ainsworth " "	1.8
Other Divisions	.4
	100.0

The bounty on lead offered by the Dominion Government is certainly responsible for the production of lead in East Kootenay, for, as was pointed out in last year's report, these mines could scarcely be operated without its aid, but the bounty has apparently had no effect in stimulating greater production in the Slocan district.

There is again this year a material increase in the output of copper, the production being 37,692,251 lbs., valued at $5,876,222, an increase over the preceding year of 1,982,123 lbs., or about 5½ per cent., while the increase in value is $1,298,182. This is the greatest output of copper ever made by the province. The increase is due entirely to the increased tonnage of the Boundary District, as all the other important districts show a falling off in production.

The following table shows the production in lbs. of the various districts for the years 1904 and 1905:—

	1904.	1905.
Boundary District	22,066,407	27,670,644
Rossland District	7,119,876	5,800,294
Coast District	5,960,593	3,437,236
Yale-Kamloops	328,380	680,808
Nelson	220,500	92,663
Various Districts	14,372	10,606
	35,710,128	37,692,251

The average assays of the copper ores of the various camps, based upon copper recovered, were as follows:—Boundary, 1.52 per cent. copper; Rossland, .90 per cent., and Coast District 2.81 per cent.

There has been no iron mined in the province this past year, since there is no market as yet available. For the small quantity formerly used as a flux in lead smelting, an impure iron ore, carrying values in the precious metals, has been substituted.

This year, for the first time, have any important sales of zinc ores to be recorded. Plants for the "enrichment" of zinc ores have been started at Kaslo, Rosebery, and Pilot Bay. These plants are merely concentrators, in which ores, or ordinary zinc concentrates, are more carefully separated, with the elimination of minerals undesirable in the smelting of zinc ore, such as iron pyrites or carbonate, galena and gangue matter.

The resulting "enriched" zinc concentrates, thus rendered saleable, have found a ready market, at prices varying according to the zinc contents and freedom from impurities, from $25 a ton for 53 per cent. zinc in a pure ore, to about $10 a ton for a 40 per cent. zinc ore not so free from impurities.

Approximately, 9,413 tons of zinc ore or zinc concentrates were sold this past year, having a value at point of shipment of about $139,200.

Almost all of this zinc ore comes from the Slocan district, but has not been all mined this past year, as the sales include zinc concentrates which had accumulated and for which only this year has a market been found.

As yet, most of the zinc ore sold has gone to the

United States, but a zinc smelting plant having this year been erected at Frank, Alberta, just east of the British Columbia boundary, in all probability the larger part of the British Columbia output will in future be treated there.

A Commission appointed by the Dominion Government, and including Mr. W. R. Ingall, New York, and Mr. Philip Argall, Colorado, spent the season of 1905 in investigating the possibilities of zinc ore mining in British Columba, and methods of treating the ore. The report of this Commission has not yet been published.

Practical demonstrations of smelting zinc-lead ores by electricity were upon two occasions attempted at Vancouver, to witness which the Provincial Government was invited to send a representative. Mr. Carmichael, the Provincial Assayer, who was present, reports that the demonstration did not succeed, for reasons which, he hopes, may yet be overcome.

Of the undeveloped properties carrying strictly zinc ore, those on Pingston Creek, in the Arrow Lake Mining Division, present the greatest surface showing.

The actual production of platinum is very small, although its occurrence in the placer gravels is so widespread through the province. About $500 worth was obtained from gravels near Granite Creek, Similkameen, while the Consolidated Cariboo Hydraulic Mining Company of Cariboo, and the Berry Creek Mining Company of Thibert Creek, Cassiar, each recovered small quantities in an experimental way, as mentioned in the reports on these districts.

A number of finds of platinum "in place" have been reported. Some of these were assayed by Baker & Sons, platinum refiners, of Newark, N.J., who reported finding considerable amounts of platinum, but upon close examination by this Bureau, confirmed by the Laboratory of the Canadian Geological Survey, of the identical ore assayed by Baker & Sons, no platinum could be found. As this has happened two or three times before, the conclusion is forced that assays made in a platinum refinery are apt to get contaminated by the dust produced by processes of manufacture.

Attention is drawn to the mention in the report of the Provincial Assayer of the finding of appreciable quantities of platinum in a number of samples of Yukon and Cassiar gold, the platinum being actually in the gold, and not a separate mineral associated therewith.

The quarrying of building stone as an industry is as yet confined to the coast, such stone as is used in the interior being obtained from some of the numerous rock exposures to be found in almost all parts of the Province.

On the Coast, in the cities of Vancouver and Victoria, particularly the former, have used an increased amount, in building, of granite, andesite and sandstone.

While no exact statistics are available, it is estimated by a leading architect that four times as much brick and stone were used in Vancouver in 1905 as during the preceding year.

Victoria brick-yards turned out in 1905 some seven and a half million brick, while about the same quantity was made in the vicinity of Vancouver. Grand Forks made two and a half million, while a number of smaller yards scattered over the province, together contributed some ten million more.

The manufacture of drain pipe at Victoria by the B. C. Pottery Company amounted in value to between $80,000 and $90,000.

The product of the Vancouver Portland Cement Company at Tod Inlet, during the past year, is estimated at $150,000, which production will be about doubled next year, by the increased capacity of the plant.

Indications of oil have been found in various parts of the province in the form of oil seepages or of shales carrying oil, but to date no oil in commercial quantity has actually been struck. In the Flathead District, on the oil seepages of which a report has already been made by the Provincial Mineralogist, some further prospecting has been done, and it is reported that a boring plant has been brought in from just across the U. S. boundary, where it has been lying for some years, but, from the best information obtainable, no drilling to any depth has yet been done.

As mentioned in last year's report, black carbonaceous shales carrying a small percentage of oil have been known to exist in the Beaver Valley, Cariboo, and this past year these shales have been taken up by a company which proposes next season to put down bore holes to test the existence of oil under the shales.

Nothing has yet been done on the Queen Charlotte Islands towards testing for oil in the vicinity of the seepages which exist there.

It cannot be said that the year 1905 has witnessed any new departures or developments in mining in the province.

The increased production in metalliferous mining is due entirely to the increased tonnage of low grade ores treated in the East Kootenay and Boundary Districts, while the other districts—Slocan, Nelson, Rossland, and the Coast—each shows this year a decreased production.

In the Fort Steele Mining Division of East Kotenay, the St. Eugene mine has this year more than doubled its output of the previous year, despite the fact that several months were lost at its most important opening, through the head works being completely destroyed by fire. The property is a large low grade concentrating proposition, galena, low in silver, in a silicious gangue. This year's output was nearly 150,000 tons of ore, producing about 900,000 ounces of silver and 36,500,000 lbs. of lead, the largest lead production of any property in British Columbia, and about 65 per cent. of the total production of the province. The North Star, which has been for many years one of our largest and steadiest producers of silver-lead ore, has been worked out and practically abandoned, as development on an extensive scale failed to disclose further ore bodies, and the small shipments made this year are only the results of the cleaning out of the old workings.

With the passing of the North Star, an adjacent property, the Sullivan, has taken its place, and is to-day the second largest lead producer in the province, producing nearly 11,500,000 lbs. of lead, or 20 per cent. of the production of the province.

Fort Steele District this year produced over 86 per cent. of the total lead production, 33 per cent. of the silver, and 50 per cent. of the coal and coke sold by the province, but no copper nor lode gold.

In the Nelson Division the tonnage of ore mined has decreased about 33 per cent. as compared with the previous year, but the gold produced has decreased only some 12 per cent., indicating that there is a proportionately larger amount of the higher grade gold ore being mined.

The copper production of the Division has decreased more than 50 per cent. a result of the inactivity of the Silver King mine, but the lead output has increased 50 per cent., owing to the resumption of the work at the Mollie Gibson (La Plata Mines) and the operating of the Alice near Creston.

At the Ymir mine, although the tonnage of ore treated is less, the amount of gold produced is greater than in 1904.

Some of the smaller mines in the district have done exceedingly well in a small way.

The plant erected at the May and Jennie has been found upon trial to require some adjustment and enlargement, and has in consequence not as yet accomplished the results which were expected, and which will, in all probability, be eventually accomplished.

In the Slocan District there was a greater number of mines shipping this past year than in 1904, but the production of lead has decreased 50 per cent. and of silver 30 per cent., due to the shutting down of some of the larger mines, such as the Payne and Ivanhoe, and the decreased production of other large properties, such as the Rambler, Slocan Star, Idaho, Wakefield, and others.

Many of the mines formerly operated under company management are now worked in a smaller way under lease or "tribute."

The market obtained for zinc ore or concentrates has been of some assistance, some 9,413 tons having brought $139,200.

The "Lead Bounty" does not seem to have had the same stimulating effect upon the lead output of the Slocan that it has had upon that of East Kootenay.

In the Rossland Camp there has been about 5 per cent. more ore mined this year than last, and while there has been but a slight depreciation in the gold and silver contents, there has been a very considerable falling off in the copper contents of the ore.

The average assay of the ores of the camp were this past year: Gold, 0.39 oz.; silver, 0.44 oz.; copper, 0.9 per cent.

In the Boundary District the tonnage of ore mined has increased about 20 per cent. over the preceding year, and now amounts to 965,628 tons, being over 56 per cent. of the total tonnage of the province.

The increase is due to the constantly increasing operations of the Granby Co., the other large companies about holding their own. The number of smaller high grade properties being operated, while not contributing any appreciable percentage to the tonnage, have helped to keep up the average grade of the ores.

The costs of mining and smelting have been gradually reduced in this section, thanks to as fine equipments as money could buy, in the hands of intelligent and scientific men, until they are now reported to be about the lowest in the world. To quote from a recent editorial in a leading American scientific journal:—

"Ten years ago the idea of smelting for a dollar a ton and mining for $1.10 would have been scouted as impossible. Yet this has been done at the Granby mines, with an exceptionally favorable ore and exceptionally well applied skill. In Tennessee, with low priced labor and fuel, they smelt a copper bearing pyrrhotite for $1.30 per ton."

On Texada Island the Marble Bay mine has sustained regular shipments, but the Copper Queen and Van Anda properties have only been prospected for further ore bodies, with little shipping. The iron mines have not been operated.

In the New Westminster District the only property working to any extent is the Britannia at Howe Sound. This company, reported on last year, has finished equipping its tramway and concentrating plant, and in December, 1905, began the shipping of crude ore and concentrates to the company's smelter at Crofton, formerly owned and built by the Northwestern Smelting Company. This plant is being remodelled, under the superintendency of Mr. Thos. Kiddie, to meet the requirements of the mine.

In the Atlin District, the placer mines held their own exceedingly well, considering the dryness of the season. No lode mines have as yet developed in this district, although on Windy Arm, just north of the boundary and in the Yukon Territory, several most promising prospects have developed, the details of which are contained in a special report herewith. From the location of these discoveries it seems probable that the mineral belt will be found to extend south into British Columbia.

Of the northern districts, the vicinity of the Portland Canal seems to promise the greatest likelihood of becoming a producing camp in the immediate future, as it is near deep water transportation.

There have been a number of discoveries in the vicinity of the Telkwa River of mineral deposits, which, if transportation was provided, might have considerable promise, but which at present, and until such facilities are provided, must remain unworked.

On the Queen Charlotte Islands a litle prospecting has been done, and an examination made of the coal fields by the Dominion Geological Survey, which, it is reported, is to be followed by active exploration of the properties of a private syndicate, but as yet no definite work has been attempted.

Mining on the West Coast of Vancouver has been at a standstill; a little prospecting has been going on, but little more. The only two properties shipping were the Hetty Green, about 200 tons of 7 per cent. copper ore, and the Cascade, 30 tons of 15 per cent. copper ore.

In the Mount Sicker District of the Victoria Mining Division the Tyee Mine has maintained average monthly shipments of between 2,500 to 3,000 tons of ore, which has been smelted with some custom ores in the company's smelter at Ladysmith. The development of this property has been carried to a depth of over 1,000 feet, but has as yet not proved up any comercial body of ore below the 300-foot level, although, since the close of the year, an exposure of ore was made on the 1,000-foot level carrying a high percentage of barytes, the gangue of the upper ore bodies, which gave much encouragement, but which there has not as yet been time to develop.

Some development has been carried on, on other properties, in the neighborhood of the Tyee, but as yet no ore bodies have been encountered.

The King Solomon mine, at Kokasilah, has made a small shipment of 40 tons of 8 per cent. copper ore, and some other properties in the vicinity are being prospected.

At Hedley, in the Osoyoos Mining Division, the Nickel Plate mine, owned by the Yale Mining Co., has been successfully operated, and there has been treated in the mill of an allied company, The Daly Reduction Co., over 30,000 tons of ore, which yielded between $12 and $14 to the ton, chiefly in gold.

In the Nicola District active prospecting operations have been carried on in the coal areas, with, it is reported, gratifying results.

The Luce or Live Yank hydraulic mine, just above the Hayward mine, on Snowshoe Creek, (of which the late W. F. Anderson was foreman and principal owner), and from which but meagre returns had been received the past three years, had this year got on to the gold run and was paying handsomely, when Mr. Anderson was taken suddenly ill and died, after which mining operation ceased. This claim will give a good account of itself in future years.

The Cariboo District, including the Cariboo and Quesnel Mining Divisions, was very much hampered throughout the season of 1905 by a scarcity of water. The Consolidated Cariboo Hydraulic Mining Company found that there were but 45,000 miner's inches available, whereas in 1904, which was also considered a dry season, there were 225,000 miner's inches of water for sluicing purposes. This scarcity of water was, of course, experienced by all other hydraulic mines, the result being that the yield of gold was very much less than had been anticipated and much less than it will probably be during the present year.

River dredging was not prosecuted during the year, though many Cariboo men have been watching many of the dredges elsewhere, as they realize that if successful dredging can be accomplished on such streams as the Lower Fraser, it will probably be very successful in Cariboo.

Very little quartz mining is attempted. W. Stevenson, Recorder for the Quesnel Mining Division, states in his report:—

"This is the third dry season in succession in this section and owing to the very light snowfall last winter, many of the small creeks and gulches ceased to flow after the snow was gone. The small surface mines located on, and others depending on, those streams, did nothing for the season, while the hydraulic mines had a very limited supply of water, for the reason that there was not enough melting snow to make and considerable amount of water in the lakes and reservoirs, which had been drained to the utmost the preceding season, and consequently, the water supply was of very short duration and the output of gold light. Hydraulic and other surface mining is our chief dependence in this section, and the shortage of snow for the last three winters has been a great drawback. The rainfall during the summer months was very light; in fact, it might be said that we had no rain from the first of May to the last of August."

Under such conditions, of course, nothing like a satisfactory yield, from these northern mining divisions, is to be anticipated unless some system superior to any in vogue at present be found for impounding the water from the melting snow.

The "Canadian Mining Review" has already published a report of the Provincial Metallurgist, dealing with the Atlin Mining Division, which now includes the boundaries of the old Teslin Mining Divisions, Mr. James Porter, of

Telegraph Creek, acting as Deputy Mining Recorder for the Atlin Mining Division.

The Northern portion of Cassiar District, which is, of course, included in the Teslin, as well as in the Liard and Stikine Mining Divisions, depend for their prosperity upon three companies, the Berry Creek Mining Company, the Rosella Hydraulic Mining and Development Company, of Rosella Creek, and the Seattle Prospecting and Development Company, working the hydraulic and creek leases on McDame Creek. Of course, the operations of the Berry Creek Mining Company were by far the most important.

The placer finds on the Clearwater, thirty-five miles west of Telegraph Creek, have not as yet shown important results,

Skeena Mining Division was marked by several new discoveries, notably on the Telkwa and Copper rivers and on Portland Canal. In the development of the former transportation difficulties will retard matters for the present, but on Portland Canal no such difficulties exist, most of the discoveries being near salt water, and the canal offering safe anchorage in all weathers.

The Queen Charlotte Islands have attracted more attention than in the past. A number of claims have been staked on Graham Island, and Moresby Island is thought to contain some seams of coal that may become of economic importance.

At Princess Royal Island considerable work is being done by an English company owning the Princess Royal group.

In southern British Columbia the Boundary District makes a strong showing. The Granby Mines had an output of 645,000 tons; the British Columbia Copper Company Mines, 189,000 tons; the Dominion Copper Company Mines, 88,000 tons; the Oro Denoro, 3,000 tons and sundry small shippers an extra 5000 tons, giving a total of 930,000 tons.

BOOK REVIEWS.

With the rapid spread of interest in producer gas, and the furnaces for its production, the appearance of a volume treating authoritatively of this important production by Mr. Samuel S. Wyer, M.E., is opportune. The work consists of thirty chapters and describes minutely the important advances and industrial developments up to the present time. The author's ability will not be questioned, as he is acknowledged to be one of the highest experts on the subject on which he writes, and the result of his numerous experiments must prove interesting and useful to all chemists, metallurgists and gas engineers. The work is published by the Engineering and Mining Journal, New York. Price, $4.00, postpaid.

Industrial Furnaces, by Prof. Emilio Damour, translated and augmented by A. L. Queneau, has been issued by the Engineering and Mining Journal of New York. Price, $4.00 postpaid. It is an exceptionally intelligent treatise on the subject, and also an advantageous companion volume to the recently issued work on Producer Gas and Gas Producers, by S. S. Wyer. The above manual has been translated with remarkable ability from the original French of Prof. Emilio Damour by A. L. Queneau, and incorporates a vast amount of fresh and comprehensive data in relation to industrial furnaces—their deficiencies, possibilities and the various advances and improvements made in the principal contrasted types. The present treatise represents the combined efforts and experiments of two distinguished experts in their especial practice, and no chemist, metallurgical engineer or other workers in the industry can afford to be without it.

PERSONALS.

Mr. Smith Curtis, of the Denoro Mines, has been in Eholt, making examinations.

Mr. H. P. Dickinson, Rossland, agent for giant powder, was in the Boundary last month.

Mr. Robert Deusler, of Spokane, has been visiting Phoenix Camp, B.C., where he has extensive interests.

Mr. D. C. Johnson, of Spokane, formerly ore buyer for the American Zinc Company, was in Nelson recently.

G. G. S. Lindsay, K.C., of Toronto, General Manager of the Crow's Nest Pass Coal Company, has been in Nelson representing his company in a case on trial at the Assizes.

Sidney Stockton Taylor, of the city of Nelson, barrister-at-law, has been appointed the attorney for the Dundee Gold Mining and Milling Company in the place of Joseph Duhamel.

Mr. Roland Machin, British Columbia agent for the Bennett Fire Company, has returned to Victoria, after a tour of the Kootenays and Boundary. He found conditions very encouraging.

Announcement is made by the Power and Mining Machinery Company, Milwaukee, Wis., of the appointment of Mr. W. A. Lieblein as manager of their Salt Lake City branch with offices at Room 215, Commercial Club Building.

Mr. James Cronin, of Moyie, B.C., and Mr. J. C. Hodgson, of Hodgson, Sumner & Company, Montreal, have been elected to the Board of Directors of the Consolidated Mining and Smelting Company of Canada, Limited.

Mr. W. C. MacDowell, formerly connected with the mining department of the New York office of the Power and Mining Machinery Company, Milwaukee, Wisconsin, has recently been appointed manager of the El Paso, Texas office of that company.

Among the passengers leaving New York for Liverpool, June 19th, on the Cunard steamer Caronia, was President W. H. Whiteside of the Allis-Chalmers Company, his wife and daughter. Mr. Whiteside and his family will visit various points of interest in England, Germany, Switzerland and France.

Mr. N. B. Roper, formerly chief engineer for the Cananea Consolidated Copper Company, Cananea, Mexico, has recently been engaged by the Power and Mining Machinery Company, Milwaukee, Wisconsin, as mining engineer to represent them at their New York sales office, No. 52 William street.

Mr. Samuel W. Traylor, President of the Traylor Engineering Co., has just returned to New York after an extended business trip to Mexico. One of the most important results of Mr. Traylor's trip was the conclusion of negotiations by which the firm of Victor M. Braschi & Co., of the City of Mexico, have taken an exclusive agency for the products of the Traylor Engineering Co., in Mexico.

MINING NOTES.

During the annual meeting of the American Institute of Mining Engineers which is to be held in London this year, commencing on July 23rd, those in attendance are cordially invited to make their headquarters at the London offices of the Allis-Chalmers Company, 533 Salisbury House, Finsbury Circus, where mail may be directed in care of Mr. J. W. Young, manager of the offices, who also is a member of the Institute.

The Dominion Steel Company received $674,800 in bounties last year and topped the list. The Algoma

Steel Company came second with $404,900, while Nova Scotia Steel got $125,768. Here are the bounties received by Dominion Steel in detail:

	Tons.	Bounty.
Pig iron (c.o.)	216	$ 487.01
Pig iron (f.o.)	131,878,814	197,818.22
Steel ingots	113,893,325	256,259.98
Steel ingots	825	229.42
Steel rods	36,680	220,085.62
		$674,880.25

The bounties paid to all Canadian concerns totalled $1,540,203.

NEWFOUNDLAND.

The work of the opening of a new iron mine at the eastern end of Belle Isle, Newfoundland, began last month, several men being engaged on the work. There is a big deposit of ore, but the companies are short of men and the work cannot be rushed as they would wish.

NEW BRUNSWICK.

It is not often that New Brunswick has a mining excitement, but there seems to be one on just now. On June 27 some men boring a well for the I.C.R., at Chatham, struck what they believed to be gold bearing sand. Next day there were 470 applications for areas made at the Crown Lands Office, Fredericton. Dr. L. W. Bailey has been shown samples of the sand, but is understood to have declined to commit himself as to the value of the sand.

QUEBEC.

The Canadian Chrome Co. of Thetford Mines, are installing an additional ten stamps in their stamp mill, which will bring it up to 20-stamp capacity. Since commencing operations about a year ago, this company has met with excellent success in marketing their product, which is of an especially fine grade of chrome iron concentrates; hence the present increase of plant. The additional equipment was furnished complete by the Jenckes Machine Co., Limited, of Sherbrooke, Que., who were also contractors for the first ten stamps.

According to a press despatch from Timiskaming, dated June 29, a wonderful discovery of free gold has been made about seventy miles north of Ville Marie at the Narrows on Opasatica Lake, two miles south of the height of land. The finders, A. Renault and A. Ollier, are now en route to Quebec to perfect their discovery. One sample they are bringing with them is about twenty pounds in weight, and is covered with free gold. They say there are not many prospectors in that vicinity. The best and cheapest route is via Timiskaming Station, on the C.P.R., thence by boat to Ville Marie, portage to Gillies Depot and boat to Quinze Lake, and destination.

The hoisting engine equipment of the Asbestos and Asbestic Co., Limited, Asbestos, Que., near Danville, has been increased this spring by the addition of four 9 x 12 special cableway hoisting engines, as built by the Jenckes Machine Co., Limited, of Sherbrooke, Que. This hoisting engine was designed especially for cableway service, having one drum for hoisting purposes, and a separate independent drum for operating the carriage on the cable. It has been extensively adopted by the asbestos mines in the Province of Quebec, also to considerable extent by the coal mines in Alberta. The Johnson's Company of Thetford Mines, have lately installed two of these engines.

COBALT.

Operations with a view to the partial draining of Peterson and Cart lakes, are now in progress.

On June 23rd, two new veins were discovered on the Jacobs mine. They are reported to be exceedingly rich in silver.

Haileybury is receiving its share of the benefits derived from the mining development, and is rapidly forging ahead.

It is reported that from four to five inches of high grade silver and smaltite ore has been struck in the 65-ft. level at the Silver Queen Mine.

Almost all the well known mines are in active and successful operation, although in the case of the Foster work is principally confined to further prospecting.

A complete air compressor plant was shipped last month from Argentine to the Silver Bar Company's property, and is expected to be in operation shortly.

The Kerr Lake Mining Co., Cobalt, Ont., is installing a 60 horse-power 54 inch x 14 foot tubular boiler, purhased of the Jenckes Machine Co., Limited, Sherbrooke, Que.

Except in the case of stock in the well known shipping mines, sales are comparatively few and far between; and financial and general business is by no means so brisk as it was two months ago.

Up to the time of writing the Temiskaming and Northern Ontario Railroad Commission have not dealt with the mineralized section of the right of way. It is stated that some good offers have been received.

A rich strike of argentite in calcite has recently been made on the McKinley and Darragh property at the extreme south end of Cobalt Lake. This mine has just been reopened after a lengthy period of inactivity.

Prof. W. G. Miller, provincial geologist for the Province of Ontario, is still in the field collecting data for his report upon the Gilles timber limit, which the Government decided to mine themselves.

A move is being made—with Haileybury as the central point—to hold meetings of the miners and prospectors at different points of the district, with a view to gauging exactly their feelings in regard to the new Mines Act.

The inspectors are still throwing open claims wholesale, and consequently "legalized claim jumping" is the order of the day, much to the dissatisfaction of those who have spent time and money in development and prospecting.

Dr. Drummond, of Montreal, spent a fortnight at the Drummond Mines, Kerr Lake, from which large shipments of ore were made during June. Diamond drilling is still in progress at the mine, with, it is stated, satisfactory results.

Cobalt is rapidly assuming the proportions of a town. Many new and important buildings having been built during the past few weeks, while several others are in course of erection. The streets are much improved by the work which has lately been done on them.

The institution of the new machinery at the Jacobs Mine (Kerr Lake Mining Co.), has been successfully accomplished, and work is now progressing at full blast under Manager Robert Jacobs and Supt. Cohen, who state the mine is looking better than ever.

The extension of the known area of where the characteristic ores of the district outcrop is highly encouraging. Discoveries have been made north, south and east of the boundaries as they were believed to exist. The finds to the south in the Third Concession of Coleman are of particular interest.

The Warner-Leith prospecting outfit which employs from 20 to 35 men, is busily engaged in trenching and other work on the "open" claims in Coleman Township, which lie between the boundary of the Gilles timber limit and the Township of Lorrain. It is reported that they have made at least one good discovery ot cobalt and silver.

Mining men will much regret to hear of the accident to Superintendent Harris, late of Sudbury, but now in charge of the La Rose Mine. Believing that three holes had been fired, he returned to inspect the result. As a matter of fact, only two had fired, the one that had temporarily missed exploded when Capt. Harris was too near. His head was badly cut, and he has lost the sight of an eye.

A petition to the Government has been extensively signed by the leading business men, who attribute the falling off in business to the objectionable clauses in the Act. Hundreds of men who were prepared to spend money in the district, in prospecting and development, have left without acquiring any interests, on the grounds that they consider the Ontario Government's demands unreasonable and unfair.

A valuable discovery of native silver has been discovered on Lot 3, Concession XI., in the Township of Lorrain, by two prospectors by name Burk and McMillan. It is stated that a Mr. Fortier, of Montreal, is interested in the claim. The vein matter is calcite, in a formation of diabase. This discovery has given a considerable impetus to prospecting in the vicinity. The inspector passed the discovery immediately on examination.

A new vein about an inch and a half wide was discovered on June 18th, on the property known as the McLeod and Glendenning; it is rich in smaltite and native silver. This vein outcrops at the greatest elevation on the claim, and it is stated that it has been traced diagonally right across the 40 acres. This makes the third discovery upon this property within the last six weeks, one of the others being a silver-smaltite vein, approximately fourteen inches wide, where exposed.

Large numbers of prospectors have gone into the townships north of Liskeard, up the Montreal River, and into the unsurveyed territory north of the Height of Land, but so far no rich discoveries of silver have been made, which can be authenticated. Most of the veins discovered have been in diabase and are narrow, the principal minerals present being galena and chalcopyrite.

Reports of gold discoveries of economic importance are, however, continually coming in by way of the Montreal River, and there seems reason to accept one or perhaps more of these reports as correct.

Cobalt mines are like the Toronto public in the sense that they are rich and easily worked, says the Toronto Telegram. One Cobalt property has already yielded $300,000, at a working cost of $18,000. Properties that can be worked so easily and cheaply need not be stocked for a million dollars and offered to the public at so much per share. A million dollars is a lot of money, even if it comes from the pockets of a multitude of small investors. The owners of a proved property in Cobalt can work their mine without the help of the share buying public. And the before-mentioned public should make sure that it is not worked by the vendors of stock in every unproved property.

Two gasolene launches and a steamboat are now carrying freight and passengers from the new townsite of Argentite (between Cobalt and Haileybury) up Cross Lake. Argentite is the natural outlet to the railroad for the ores of the Kerr Lake and the southeast section of the district. All three boats are exceedingly busy.

Mr. Smith, Mining Recorder at Haileybury, is still kept busy issuing mining licenses, over six hundred having been issued since the new Mines Act came into operation. There is, however, a marked falling off in the number applied for during the last month, prior to which some fifty per day were granted. This in some measure appears to be due to the fact that the new Mines Act is by no means meeting with approval, the more intelligent class of prospector objecting strongly to some of the restrictive clauses, particularly those relating to "inspection" and "discovery."

The Cobalt Townsite Mining Co. have discovered a new vein of almost solid smaltite and silver, about three in. wide. Illustrative of how close one may be to fortune and yet miss it, this new vein had almost been exposed by the railroad contractors in the gravel pit south of Cobalt Station, where thousands of yards of ballast had been removed. An employee of the Townsite Company, on June 22nd, while digging sand for use, came across the vein by accident.

This company owns about 40 acres in the Cobalt townsite, which is held under a long lease from the Temiskaming and Northern Ontario Railroad Commissioners. Work has only been in progress for less than a month, but discoveries already warrant the belief that the property will develop into one of the important producers of the camp.

Work has re-commenced on the Hunter claim, in the first concession of Bucke Township. Development was begun upon a small stringer carrying chalcopyrite, but in the shaft smaltite and native silver in quantity were struck. The shaft is now about 45 feet deep .

BRITISH COLUMBIA.

Mr. T. J. Ferguson, of Phoenix, has been appointed superintendent of the Iron Mask at Kamloops.

It is understood that $100,000 will be spent in development on the B.C. Copper Co.'s Mother Lode mine in the next few months.

At the Mountain Rose the Dominion Copper Co. is running a tunnel, from which a raise will connect with the shaft already sunk.

Mr. T. W. Thomas, M.E., of New York, consulting engineer to the B. C. Copper Company, has been visiting the coast and was recently in Greenwood, B.C.

The British Columbia Copper Company has just completed negotiations for the B. C. mine, in Summit Camp, a few miles from here. The ore is a good flux and runs high in copper values.

George A. McLeod has just returned from making a personal inspection of the Maple Leaf group in Franklin camp. He corroborates the report of the recent strike of copper ore on this group.

The ore from the Jersey mine, on the West Fork of the Kettle River, is said to be rich in cobalt. This is the first cobalt recorded from that district and considerable interest is being taken in the find.

There was a small placer gold excitement on the Tulameen recently. During the progress of work on a road the laborers uncovered a body of rich-looking sand. Everyone around took a hand in locating.

The English syndicate that bought the Mallory copper claims on Howe Sound a few weeks ago, are already beginning operations. So far $300,000 are said to have been spent in purchase and supplies.

The Boundary district continues the scene of ever increasing activity, properties of known value continue to pass into the hands of people with plenty of capital, who are making arrangements to develop their new holdings.

Mr. Charles T. Hancock, of Dubuque, Iowa, is back on the coast. This is thought to indicate the resumption of operations of the Iowa-Lillooet Dredging Company at Lillooet. This company has been tied up with litigation for some time.

The profits of Le Roi for May reached the very respectable sum of $50,000. This mine has made a profit of from $30,000 to $50,000 for every month of the present year. Le Roi No. 2 is making large profits—larger than ever before in its history.

The Big Copper, Copper Camp, has changed hands and is to be developed. It is a medium to low grade property but capable of yielding a big output of ore. Last winter six hundred tons were shipped to Greenwood, and gave returns of about $14 a ton.

Manager Hand of the Ymir mine, has made a favorable report of this famous property. Since June 6 thirty stamps have been dropping, and forty stamps could be supplied if labor were more abundant. The daily output of the mill is 90 tons, or 630 tons a week.

Two diamond drills are not sufficient for the management of the McKinley, Franklin Camp, B.C., mine, in consequence of which contractor Dave Evans has just hauled another diamond drill to the property, so that the three drills will be working in a few days.

The latest claim acquired by the Granby Company is the Bank of England. This is a fraction of 29.57 acres, adjoining the Monarch, Tamarack and Rawhide, each owned by the Granby. By acquiring the Bank of England it is expected that the development of the Monarch at depth will be facilitated.

For the three months ending 31st March, 1906, there were 86,647 tons of different kinds of ore received at the Consolidated Mining and Smelting Company's Smelter at Trail. Of this 32,599 were smelted. The output of the smelter was as follows:—

Gold	34,434 ozs.
Silver	619,013 "
Copper	1,226,567 lbs.
Lead	8,340,000 "

The gross value of which at the full quotations for the metals was $1,622,242.

Dredging on the Fraser River for gold is an enterprise which goes steadily on. In past years a large number of machines have been at work at different times, and a very considerable amount of money has been expended. There is under construction at Yale a dredge which will operate in the river near that place. Mr. Walter Williamson, who has had experience in dredges in New Zealand, is looking after the interests of the company. Near Lytton another dredge is in operation. This is in a quiet part of the river just below the point, which has long been one of the favorite locations for dredges.

The areas of the claims held by the Granby Company are as follows:—

Old Claims.—Knob Hill, 19.09 acres; Old Ironsides, 20.18; Victoria, 46.60; Myrtle Fraction, .07; Phoenix, 29.94; Aetna, 24.91; Fourth of July, 29.44; Grey Eagle, 33.80; Banner, 47.59; Tip Top, 44.32; Triangle Fraction, .66; Old Ironsides Fraction, 42.12; total, 338.73.

Claims Bought Last Year.—Monte Carlo, 51.60; Monte Cristo, 22.00; Monte Cristo Fraction, 2.50; Gilt Edge, 49.80; Gold Drop, 35.00; Gold Drop Fraction, 13.50; Nuggett, 46.13; Phillipsburg Fraction, 1.50; No. 13, 22.10; Monarch, 51.13; Tamarack, 49.60; Tamarack Fraction, 2.50; Missing Link, 6.70; total, 354.06.

Claim Just Acquired.—Bank of England, 29.57; total acreage, 722.36.

It is the intention of the management of the Granby Smelter to close down the works for two days for repairs. When operations recommence, No. 2 furnace will be enlarged to the same capacity as No. 1. The work will probably be accomplished in fifteen days. This will be followed by the enlargement of the other small furnaces as rapidly as possible. The increased furnace capacity necessitates more blast, and two new Jumbo blowers of the No. 10 type will be installed. They will be placed in a blower room which will be built on to the converter blower building, the foundations being almost ready now. Four new motors of 150 horse power each will be placed in commission. To meet the additional demand of the furnaces three new electric motors have been ordered for the charge cars, also a new duplex pump with a capacity of 750,000 gallons per 24 hours. A third converter stand will be placed in position in the course of three or four days, the foundations having been completed during the past week. Masons are a scarce quantity and several more could be used to good purpose in the general work at the Granby.

ATLIN.

The Northern Mines, Ltd., R. D. Fetherstonhaugh, manager, have completed the construction of a wing dam on Spruce Creek. A number of men have been employed in mining and sluicing the rich draw which extends through the company's pit.

Work on the N.C.G.M. Company's dam at Surprise Lake has progressed very favorably. Although considerable frost was encountered while excavating, that part of the work was completed a month ago, since which time the workmen have been busy on the sluice-ways and foundation.

COAL NOTES.

Shipments from the Springhill, N.S., collieries for the month of May were 33,912 tons.

The Rand Drill Co. is introducing a new undercutting machine in C.B., and is meeting with much success.

Some fifty old country coal miners under engagement with the Dominion Coal Company arrived recently from Scotland.

The Drummond Colliery has a daily output of 1,200 tons. The distance from surface to face is 6,880 feet, actual measurement.

Shipments from the Cumberland Railway & Coal Company's collieries, at Springhill, N.S., for the month of June were 33,259 tons.

The contract for supply of coal for the Prince Edward Island Railway goes this year to the Gowrie and Blockhouse Collieries, Ltd.

Mr. Russell, who went from Nanaimo last fall to have a look over the Inverness collieries, has left and gone to other McKenzie and Mann properties.

About 500 new mine boxes—mostly two tonners—have been built at the Dominion Coal Company's car shops and sent to the mines during the past two months.

A Stanley header will be put in operation at No. 2 Allan Shaft as soon as the new compressor is erected. The compressor has been shipped and should be in position in a few weeks.

Notwithstanding the influx of strangers to the Cape Breton mines, labor is by no means plentiful in Cape Breton, and latest accounts indicate that it is getting scarcer. The Newfoundland fisheries are draining Cape Breton of natives of that Island.

Preparations are in progress for the sinking of yet another lift in the main slope at the Drummond Colliery. The lift will be 500 feet. When completed the total length of the main slope will be 7,380 feet.

Twenty men are working in the Williams coal mine and five men at the Seimer coal mine, on Coal Creek, Yukon. Thousands of tons of coal will be taken out there this summer for shipment to the Dawson market.

Sinking of the slope at Mabou has been suspended for the present. The pit is being worked double shifted. The coal at present is being banked, and put into the pockets. It is expected to get an average of about 226 tons per day in June.

The 32 coke ovens of the Intercolonial Coal Co. turn out 1,100 tons of superior coke monthly. The coke is in large demand; the Londonderry Iron Works being anxious to get all of the product. The coke takes seventy-two hours in burning.

The mines of the International Coal & Coke Co., of Coleman, B.C., are turning out for shipment over 1,200 tons of screened coal per day. Besides the coal shipped from that point about 125 tons of coke per day is made and shipped to B. C. points.

A "Scaife" trough washer is being erected, at the Drummond, with elevators, conveyors and storage. These are to be run in conjunction with the washer. The capacity of the washer plant will be 150 tons a day, sufficient for all immediate requirements.

The Drummond Colliery now has two steamers in the St. Lawrence trade, the "Havso" and the "Atlas." They will carry some 16,000 tons of coal per month. The Acadia Company have also two boats, the "Unique" and the "Pimes," with a carrying capacity of 21,000 tons. The shipments to the St .Lawrence this season will total a tidy figure from Pictou Co. this season.

Approximate output of the Dominion Coal Company's mines for June, 1906, was:—

Dominion No. 1	43,568
" No. 2	51,880
" No. 3	37,541
" No. 4	52,777
" No. 5	62,506
" No. 6	3,399
" No. 7	15,479
" No. 8	24,932
" No. 9	33,866
Total	325,948

President Howard, of the Western Fuel Company, arrived in Nanaimo, B.C., from San Francisco a few days ago, and after consultation with the local management, the colliery company decided to close the Brechin mine down for an indefinite period. Business in San Francisco has been completely paralyzed by the earthquake, and the consumption of coal has been curtailed to such an extent that with the 'Frisco bunkers and yards of the company running over with coal this step was found necessary. In the meantime No. 1 mine will be kept working full time as the sale of enough coal has been obtained to guarantee this. There are 800 men working in No. 1 now, and in addition to this work will be found almost immediately for about 150 men from Brechin, leaving about 200 men out of employment.

The west level in the Foord seam of the Allan Shaft is in 600 feet from the bottom. At 1,000 feet from the bottom the first balance, likely, will be driven. On the same side in the Cage seam the level is in 766 feet. On the east side the level of the big seam is in 375 feet. This level is not driven in the coal, but will strike it at say 400 feet, or in a day or two. The level in the Cage seam, east side, is in 400 feet, and has been driven all the way in coal. Only 7 feet of the big seam is as yet being mined. It is mined about 7 feet from the bottom. About 14 feet of the Cage seam will be worked. The management may make a change in the mode of working when development work is more advanced. On the west side all the coal will come by way of the Cage seam drift and in order to make this successful the drift is being widened.

There is much activity around the Allan Shafts of the Dominion Coal Company. There is a lot of work to be done before the surface works are put in ship-shape order. An open cutting is being made sloping towards the No. 1 shaft, which it will strike at the broken ground. The shaft will be concreted on all sides for fifty feet from the top down. By way of the open drift the timbers will be taken to the shaft the full length required, over thirty feet, without the necessity of cutting them, which would be necessary otherwise. This work will take considerable time, but will be completed before the steel bank head is erected. There will be no hoisting of coal from the No 1 shaft. Powerful engines will be put up, capable of hoisting at high speed. There will be double deck cages, each deck carrying a box containing a ton and a quarter of coal.

THE MINING AND INDUSTRIAL SHARE MARKET.

(Specially reported for the CANADIAN MINING REVIEW by ROBERT MEREDITH & Co., Mining Brokers, 57 St. François Xavier St., Montreal.)

In mining stocks business is fairly active. The market has broadened out considerably, and there has been an almost universal advance in prices.

There is nothing of importance to note, beyond the almost daily published reports of the advance of the mining industry, both in the east, as well as the west. Capital is being attracted, and it is now easier to procure funds for a "bona fide" enterprise than has been the case for some years.

In industrial stocks there has been comparatively little doing. The speculative market has been hampered by the stringency of money, causing brokers considerable difficulty in finding loans. Prices are a little lower, and from the limited amount of trading, it would look as though the public is not in the market.

The latest quotations are as follows:—

	Bid.	Asked.
Can. Cons. Mines	135	138
Can. Gold Fields	7	7¾
Granby Cons.	10¾	11
Rambler Cariboo	25	26
North Star	5¼	9
Monte Cristo	2	3
White Bear	7¼	8
California	2	...
Virginia	2	...
Deer Trail	1½	2½
International Coal	50	51
Sullivan	2	3
Jumbo	23	25
Cariboo-McKinney	1½	2½
Denoro	8	9
Diamond Vale Coal	19	22
Dominion Copper	2¼	2½
Dominion Coal (common)	76	78
Dominion Coal (pref.)	...	...
Dominion Iron & Steel (com.)	25½	26
Dominion Iron & Steel (pref.)	75	78
Intercolonial Coal (com.)	...	...
Intercolonial Coal (pref.)	...	...
Nova Scotia Steel & Coal	65	66
Nova Scotia Steel & Coal (pref.)	118	...

COMPANY NOTES.

Allis-Chalmers.

Directors of the Allis-Chalmers Company have decided upon a large issue of bonds for the retirement of floating indebtedness and for the construction of new plants and other improvements.

At present the company has no bonded indebtedness, nor has it had any since its organization in May, 1901. In the five years of its existence it has largely increased its facilities and has paid for most of the increase out of earnings. It paid seven per cent. dividends on the preferred stock up to February, 1904.

Officers of the company say that earnings for the current fiscal year will show a large increase.

INDUSTRIAL NOTES.

A new industry is to be located in Victoria, B.C., that of a mining machinery factory. The Canadian Mine and Smelter Co. intend opening a branch here in the near future.

The Los Angeles Railway Co. has ordered from the Westinghouse Electric & Manufacturing Co., at one time, two hundred forty-horse power electric motors, which will be used in the equipment of fifty new cars which the company is adding to its rolling stock.

The Jenckes Machine Co., Limited, have recently shipped to the Alberta Portland Cement Co., Calgary, a complete hoisting plant consisting of 40 h.p. locomotive boiler and 7 x 10 hoisting engine, together with hoisting rope, steam piping, etc. The order was placed with the company's Rossland office.

The Consolidated Mining & Smelting Co. of Canada have ordered from The Jenckes Machine Co., Limited, Sherbrooke for use at the Centre Star Mine, ,Rossland, a 36 in. x 24 in. Farrel Bacon Ore Crusher, of which the capacity is 1,000 ton to 6 in. cube every ten hours. The shipping weight is 60,000 lbs.

The "Iron Age" says:—"The flow of orders in the finished trade continues very large. No better proof of this can be furnished than the fact that during the first twenty-two days of the current month (June) the United States Steel Corporation booked orders at the rate of 37,000 tons per day. This compares with 18,600 tons per day during the corresponding period of 1905, thus showing practically double the quantity. The pressure from buyers abroad is particularly noteworthy, and foreign markets have been responding.

The Rossland office of The Jenckes Machine Co., Limited, Sherbrooke, Que., has closed a contract with the Dominion Copper Co., Boundary Falls, B.C., for one of their 42 x 30 Farrel Bacon Ore Crushers, also for a 10 x 16 Crusher of the same pattern. The capacity of the larger machine is 1,500 ton to 6 in. cube in a day of ten hours, and the shipping weight is 125,000 lbs. It is the largest pattern jaw crusher so far built anywhere. Several of these crushers have been put in use by the Granby Smelter of Phoenix within the past three years.

The new rubber cement factory of the Canadian Rubber Company of Montreal, Limited, is now in full operation, and exclusive contracts for the supply of rubber cement have now been concluded with some of the principal manufacturers of the Dominion. This industry promises to be a very important one, and the plant of the Canadian Rubber Company is equipped with all the latest appliances for the production of high grade cement.

Mr. A. D. Thornton, Technical Superintendent of the Company, devotes a good deal of his time to this special branch of manufacture.

MINING INCORPORATIONS.

QUEBEC.

The Cobalt Exploration Company, Limited. Capital, $30,000, in shares of $100 each. Head office: Montreal.

ONTARIO.

Cobalt Securities Company. Capital not to exceed $50,000 in Ontario. Mr. Robert Irwin Towers, Sarnia, Ont., attorney.

Manitou Mines Company, Limited. Capital not to exceed, in Ontario, $40,000. Mr. Hugh D. Ralston, Wabigoon, Ont., attorney.

The Soo-Cobalt Mining Company, Limited. Capital, $50,000, in shares of $1.00 each. Head office: Cobalt, Ont. Provisional directors: Messrs. Clifton Henry Moore, Charles Maitland Tilkie and Creighton DeWolfe.

Gallagher Iron Mining Company, Ltd. Capital, $500,000, in shares of $1.00 each. Head office: Sault St. Marie, Ont. Provisional directors: Messrs. Francis Patrick Sullivan, John Joseph Gallagher and Francis Houghton Hughes.

The Cobalt Smelting and Refining Company, Limited. Capital, $250,000, in shares of $1.00 each. Head office: Toronto, Ont. Provisional directors: Messrs. Thomas Henry Miller, Clarence Howard Gowman, Joseph Henry Schlund, William Richard Cavell and Henry Alfred Wright.

North Ontario Reduction and Refining Company, Limited. Capital, $500,000, in shares of $1.00 each. Head office: Toronto. Provisional directors: James Alexander Young, jr.; Henry Billings Ritchey, John Jennings Wright, Donald Gunn Bremner and Joseph Scott Tomenson.

The Cobalt Central Silver Mining Company, Limited. Capital, $500,000, in shares of $1.00 each. Head office: New Liskeard, Ont. Provisional directors: Messrs. Thomas McCamus, Donald Stewart, Arthur Wentworth Roebuck, Fergus Lawrence Hutchinson and Donald Harrison Walkinshaw.

BRITISH COLUMBIA.

The A. R. Williams Machinery Company of Vancouver, Limited. Capital, $100,000, in shares of $100 each.

Northern Ventures, Limited, Victoria, B.C. Capital, $10,000, in shares of $100 each.

Britannia West Copper Company, Limited. Capital, $500,000, in shares of $5.00 each.

Boundary Mining and Exploration Company, Limited. Capital, $200,000 in shares of $1.00 each.

The Otter Creek Development Company. Head office: Toledo, Ohio. Capital, $20,000, in shares of $1.00 each. Head office in Canada is at Atlin, B.C. Alfred Carmichael, Atlin, attorney for the company.

Bullion Hydraulic Mining Company. Head office: Wilmington, Delaware. Capital, $250,000, in shares of $100 each. Head office in British Columbia is situated at Bullion. Attorney for the company John B. Hobson, Bullion.

Cornell Operating Company. Head office, Seattle, Washington. Capital, $14,000, in shares of $1.00 each. Head office in British Columbia is situated at Van Anda, Texada Island. Attorney for the company, Mr. A. G. Deighton, Van Anda.

CATALOGUES.

A pamphlet on the Westinghouse Alternating and Direct-Current Motors, No. 7049, has been issued by the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa .

Northern Electrical Manufacturing Company, of Madison, Wis., have issued a pamphlet descriptive of the Northern Single Voltage Variable Speed Systems. All the motors manufactured by this Company are illustrated and the mechanism carefully explained.

Canadian Westinghouse Company, of Hamilton, Ont., have issued a circular No. 1128, descriptive of the small power motors they manufacture. Some of these small motors are merely of sufficient power to run a neostyle or other small machines needing but 1-20 horse power.

Vertical engines of the Class VS5, are treated of in the Sturtevant Bulletin No. 125, recently issued by the B. F. Sturtevant Company of Hyde Park, Mass. These engines are high speed and automatic, and are adapted for all classes of work requiring maximum power in minimum space.

The Allis-Chalmers Company, represented in Canada by Allis-Chalmers-Bullock, Limited, of Montreal, have issued Bulletin 1413, dealing with cyanide plants and their equipment. This is much more comprehensive than the usual commercial catalogue, and should be in the hands of all who are interested in the cyaniding of ores.

Westinghouse Electric & Manufacturing Company of Pittsburg, Pa., have sent out Circular No. 1134, describing the electrical and mechanical brakes for Westinghouse Type K Motors. Also Circular No. 1129, describing Westinghouse No. 119 Railway Motor for Direct-Current Service.

The Carter Auto-Magnetic Ore Separator Company, 123 Liberty street, New York, are sending out a pamphlet descriptive of the Carter Auto-Magnetic Ore Separator. This separator will not only operate on iron ore but is also specially adapted for the separation and removal of iron from gold or plantina bearing sand, or in fact from any substance where an admixture of iron is objectionable or injurious.

Sturtevant Mill Company, Harrison Square, Boston, Mass., has issued a well illustrated descriptive pamphlet of their Rock and Ore Crushers. These include coarse breakers having capacities from 8 to 80 tons per hour, when the jaws are set to 2 inches, as well as Roll Jaw Fine Crushers, crushing to half inch without screens. It is claimed that no other single machine can reduce large blocks of hard rock to half inch without screens, and that they never clog.

The De Le Vergne Machine Company, of New York, has just put out a very handsome descriptive catalogue and price list of the Hornsby-Akroyd Oil Engine. Fourteen thousand of these engines are now in use, showing that this is an honest engine at at an honest price. It is claimed that these engines have no equal for small and medium sized power and lighting installations, and the United States Government is using hundreds of horsepower Hornsby-Akroyd engines in connection with the wireless telegraph stations, fortifications and lighthouses, where hundreds of lives might be sacrificed by a momentary failure of power.

A very handsome, well illustrated bulletin (No. 1504) has been issued by Allis-Chalmers-Bullock, Limited, Montreal. It describes the Allis-Chalmers steam turbines and generators. There is a great deal of interest in this subject just now, and these turbines should atract more than usual attention owing to the balance pistons and the arrangement of the blading, The balance piston is a simple yet effective device which will be found fully described in the pamphlet under consideration. The Allis-Chalmers system of blading differs from the older methods in that each blade is individually formed by special machine tools, so that at its root it is of angular dovetail shape, while at its tip it has a projection.

The B. F. Sturtevant Company, Hyde Park, Mass., has issued Bulletin 131 descriptive of its horizontal engines. The Sturtevant Horizontal Centre-Crank Engines of Class H. C. 1 have all the features desirable for the driving of direct connected generators, for which purpose they were particularly designed. Modifications insure successful operation, as independent engines. Ample bearing surfaces, abundant lubrication, and light, but strong parts, all admit of very high speed, which may be closely regulated by the automatic governor.

The B. F. Sturtevant Company has issued Bulletin 128 descriptive of their Economizers. The Sturtevant Economizer has the pipes arranged "staggered" instead of in straight rows, thereby greatly increasing efficiency. A saving of 10 per cent. to 20 per cent. in fuel is effected by supplying the boiler with water at a temperature above boiling point. The boiler capacity is practically increased from 20 per cent. to 40 per cent., for practically all the heat passing through the boiler heating surfaces is used for vaporizing the water. The Sturtevant Economizer is made in two classes, the "Standard" and "Pony." The smaller type is commonly used in plants from 50 to 500 h.p., while the Standard is better adapted for capacities of 350 h.p., or over. The general office and works of the B. F. Sturtevant Company are at Hyde Park, Mass.

DOMINION OF CANADA

SYNOPSIS OF CANADIAN NORTH-WEST MINING REGULATIONS.

COAL—Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of 10 cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ—A free miner's certificate is granted upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner having discovered mineral in place, may locate a claim 1,500 feet x 1,500 feet.

The fee for recording a claim is $5.

At least $100 must be expended on the claim each year, or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey, made, and upon complying with other requirements, purchase the land at $1 an acre.

The patent provides for the payment of a royalty of 2½ per cent. on the sales.

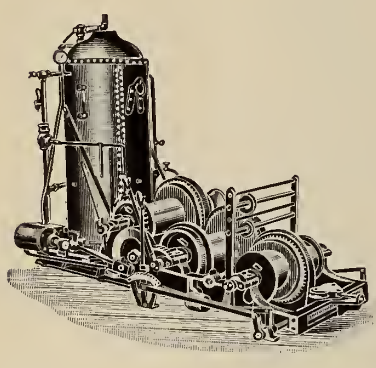
Placer mining claims generally are 100 feet square ; entry fee $5, renewable yearly.

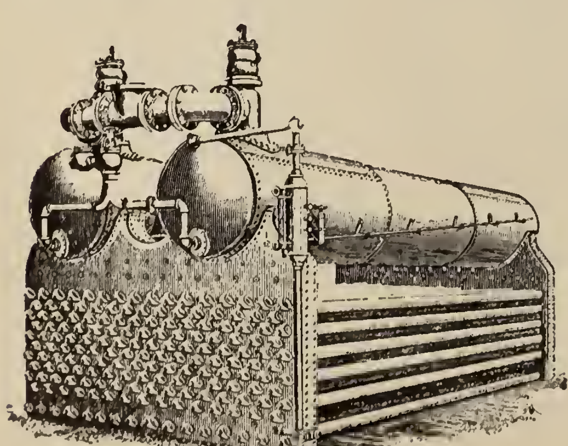
A free miner may obtain two leases to dredge for gold of five miles each for a term of twenty years, renewable at the discretion of the Minister of the Interior.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles. Rental $10 per annum for each mile of river leased. Royalty at the rate of 2½ per cent. collected on the output after it exceeds $10,000.

W. W. CORY,

Deputy of the Minister of the Interior.





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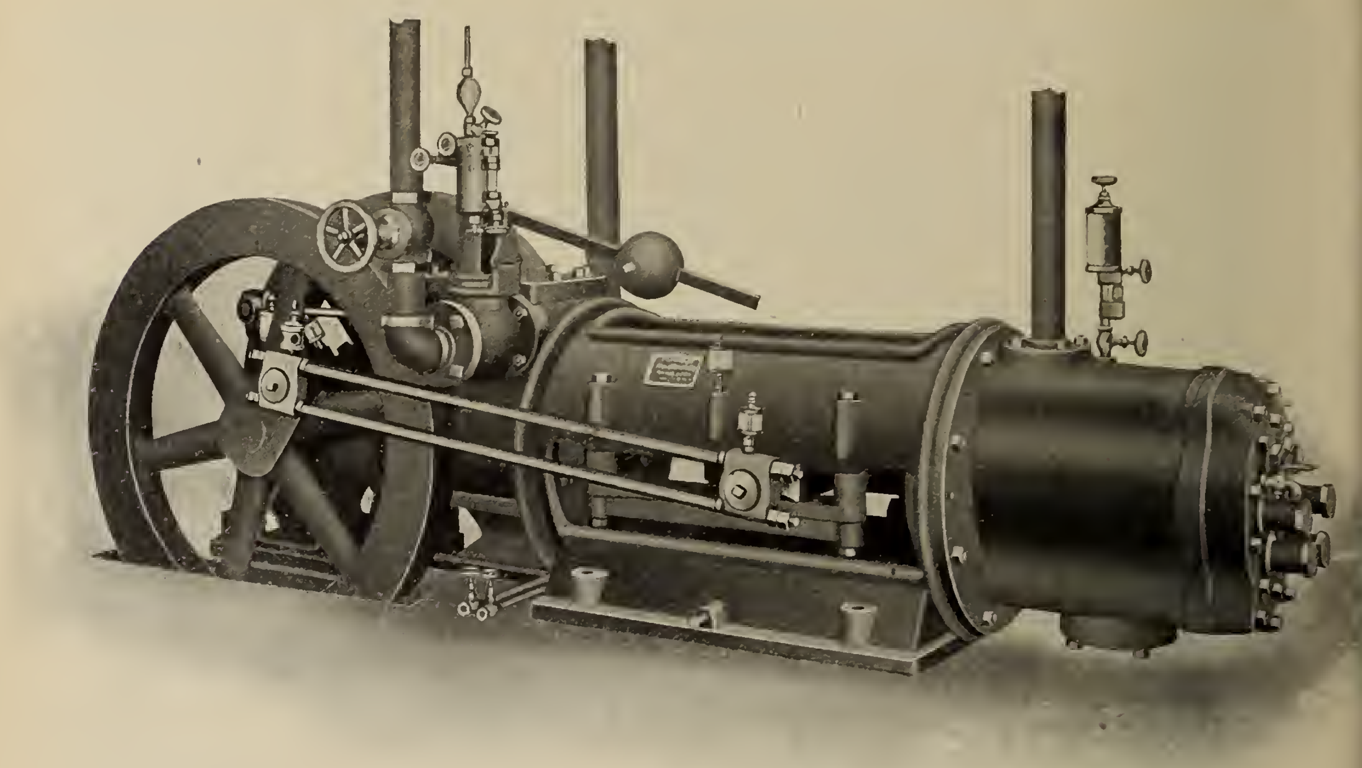

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CONTENTS.

Recent paragraphs in the press of Ottawa and Montreal have conveyed an impression that Mr. W. R. Brock, of Kingston, had been promoted to the position of Director of Geological Survey of Canada; other notices conveyed the impression that he had been appointed Chief Geologist, implying that Dr. Robt. Bell had resigned.

Neither statement is accurate. Mr. Brock has merely received well-earned recognition, in the shape of an increase in salary, and the offices of Director and Chief Geologist remain exactly as before. It is regrettable that the daily press does not employ writers whose chief object is accuracy in the news they send to the printer.

At the last session of Parliament, an Act was passed that will be known as the "Miners' Lien Ordinance." It provides that any persons who performed any work or service upon or in respect to a claim, or supplies wood to it, shall, by virtue thereof, have a lien for the price of such work or services or wood, upon the said mining claim, and all belonging thereto. The claim to this lien may be registered at any time within thirty days after the labor being performed, or the wood furnished, or within thirty days after the time fixed for payment; or should the work or wood have been furnished between the first day of November and the thirtieth day of April, within thirty days from the latter date. If steps are not taken to realize upon this claim within sixty days from the registration of the lien, it shall absolutely cease to exist.

The issue of the *Engineering and Mining Journal*, of New York, for July 7th, gives considerably more Canadian news than is usual with American publications. Straws show which way the wind is blowing, and when the leading professional publications of the United States are willing to give up so much space to Canadian matters it is clear that the Dominion is occupying an important position in the estimation of our enterprising cousins south of the international boundary line. We are glad to notice this change of heart, and we hope that their enterprising and progressive mining men will come up in larger numbers and see what we have to offer.

Canadians have no reason to be ashamed of their country either in its showing of minerals, timber or farming lands, or men.

The *Engineering and Mining Journal* has absorbed the *Mining Magazine.*

As regards mining, it is always a feast or a famine. But a few short months ago people were thoroughly incredulous as to the value of the Cobalt mining field; now estimates are from $25,000,000 to $50,000,000 for individual mines. While we should be unwilling to say, positively, that any one mine will not produce $50,000,000, still we opine to the belief that it will be safer to take off a few naughts when calculating the probable yield. After all, when owners claim that some of the better known mines will have a productive depth of 1,000 feet, it is the merest guess-work, for even the La Rose Mine is as yet only down 250 feet. It is true, however, that mineral has been found in the Keewatin, which is the formation underlying the lower Huronian conglomerate, and which was but a few months ago considered barren. The CANADIAN MINING REVIEW hopes earnestly that there may be many mines in the Cobalt camp that will yield $50,000,000 and upwards. In the meantime, let us keep our estimates under severe restraint, and not let these naughty, irresponsible, deceptive ciphers get the better of us.

NICKEL AND MICA.

In two mining products at least, Canada can hold its own with any other part of the world. These are nickel and mica. India is Canada's chief competitor in mica, but cannot for many years more continue to be a serious opponent, owing to the fact that the surface deposits of Bengal are being gradually exhausted, and deep mining would place the mica industry of that large province on practically the same plane as it is in Quebec. At present, the cheap woman and child labor of India gives that country an unhealthy pull as compared to our more advanced views.

New Caledonia, the convict island in possession of France, is Canada's chief competitor in the production of nickel, but since the wonderful development in the Sudbury district, New Caledonia has had to take second place. The Sudbury district is to-day the only portion of the Dominion in which nickel is being worked on a large scale, but a study of the Geological Survey reports makes it clear that there are great possibilities of other rich nickel deposits being discovered.

This useful metal which, owing to its increased use in the manufacture of armor-plating, is being more eagerly sought after day by day, is likely to have another boom due to a very different cause. The Government of India have, for some time, been considering the possibility of substituting nickel for copper coins. Last summer the master of the Calcutta mint paid a visit to the Sudbury mines and has, it is understood, reported favorably on the suggested conversion. What the Indian Government has decided to do in this matter is not definitely known, but to judge from the Indian newspapers, there seems a strong probability of the copper coins being very largely withdrawn.

Any new deposits of nickel must therefore attract more than ordinary interest, and such interest is certainly inspired by reading of the discovery lately made in the Fraser River.

In working the material obtained in dredging for gold some two miles below Lillooet, B.C., it was found that a fine, heavy grayish sand with a metallic aspect remained after the clean-up.

A sample of this sand was sent to Dr. Hoffmann, chemist of the Geological Survey, for examination, and was found by him to consist essentially of an iron-nickel alloy with scales of platinum, grains of the rare metal iridosmine, gold, magnetite, garnet and quartz.

The nickel alloy and platinum were nearly in equal proportions and constituted about 90 per cent. of the whole.

This nickel-iron alloy is especially peculiar owing to the large amount of nickel it contains, namely, over three-quarters of the whole.

Only two occurrences of similar minerals are known, one in New Zealand and the other in Italy; it is proposed to call this new mineral souesite after Mr. F. Soues, who sent the sample for identification.

The large amount of platinum in these sands and the ease with which the nickel alloy may be separated by dissolving in nitric acid, leads to the hope that we have here a new source of this valuable metal.

AS TO SOME GOVERNMENT REPORTS.

There is perhaps no more effective way of hiding a statement than the putting of it in a Government report. The man on the street fights shy of Government reports. It is only a misguided few who, having the old-fashioned craving for truth, delve into such things. This is why the daily papers are saying so much just at present about the discovery of certain rare earths in the Province of Quebec. If they as well as the public had mastered the contents of the last Blue Book—which, by the way, was yellow or red—issued by the Department of Colonization, Mines and Fisheries, of the Province of Quebec, they would have found a brief description of these discoveries, by Monsieur H. Nagant, a French chemical engineer. One of his paragraphs says: "With the progress in industrial chemistry now being made in connection with these interesting substances, new and remarkable properties are constantly being discovered and the applications of which they are susceptible are occupying more and more the attention of specialists. Finally, in these same rare earths are disseminated the famous radio-active metals, such as radium, polonium, radio-active thorium and uranium." The writer very properly points out that in the Province of Quebec the study and exploitation of rare earths is only in its inception. Only a few years ago, minerals that were considered valueless and thrown aside as refuse from the mica mines, may well become of such importance that the mica itself will be a secondary product. Even so long ago as 1901, Mr. J. Obalski, the Inspector of Mines, gave some interesting details regarding some of the minerals and rare earths found in various parts of the province. But, as we said before, the way to bury a fact deeply is to put it into a Government report.

Speaking of Government reports: How many people read the report of the Surveyor-General of Dominion Lands, issued annually by a paternal government? Yet, if you want a detailed description of distant and unfrequented parts of our great Dominion you could not go to a better source. The surveyor is not generally a man of much imagination, but he is accurate and precise. Moreover, he rarely has an axe to grind, so that what he says is worth paying attention to. The difference between these reports and the lurid productions that are issued by interested persons is marvellous, hence, perhaps it is just as well that the intending immigrant does not always find access to the reports of the Surveyor-General. But we think that the readers of the Canadian Mining Review are not likely to be influenced adversely by perusal of these reports. On the other hand, we feel sure that many of our roving engineers will find a good deal of information in them that may be turned by a shrewd man into hard cash.

With the coming of the Grand Trunk Pacific, the Peace River is likely to attract a great many people, and in the last report of the Surveyor-General, for the year ending June 30th, 1905, there are some reports by Dominion land surveyors that give a very fair idea of the country through which the Peace River flows, from its birth on the western side of the Rockies, to its final merging in the Slave River, which is but another name for great Mackenzie.

PROFITS IN MINING.

The summary of the mining production of the United States recently given by the Chicago Mining World shows that the industry for the first half of this year has been unusually profitable. It also shows, and this is of still more value, both to the investor and the mining engineer, that this profit is more the result of improvements in methods of mining and reduction, than of new discoveries in old mines or of new districts. It should, however, be noted that not a small proportion of the profits are directly due to the higher market prices which have prevailed for copper, lead and silver.

As in previous years, the mines which produce copper are easily in the van of profitable mining properties. From twenty-four listed corporations the dividends for the first six months of 1906 aggregated $25,586,613 and of this number 10, or practically 40 per cent., have returned a total of dividends which is larger than the total of their capital stocks. At the head of these copper companies comes the famous Calumet and Hecla, of Lake Superior, the capital stock of which is $2,500,000; and whose dividend for the first six months aggregated $3,000,000. In the 35 years of its existence, this mine has paid out to its shareholders in the form of dividends the sum of $95,350,000, nearly 40 times the par value of its shares; in other words the average dividend has been 100 per cent. per annum. No wonder that the average quotations of these shares is between $600 and $700, for a par value of $25.00.

The gold, silver and lead companies on the list, 58 in number, paid in dividends for the first half of this year $13,143,671; of this total, seven have returned their capital. The chief mine on the list is the Old Homestake, of South Dakota, which paid $665,200.00 on a present capital of $21,840,000, making the full disbursements in dividends from this property within $2,000 of $15,000,000. The second largest gold mine is the Alaska Treadwell, and the third is the Portland, of Cripple Creek, Colorado.

A little comment, we think, may be made on these figures by the Review. Mining, when conducted as an industry by men whose reputations for honesty and ability are unquestioned, is one of the most profitable and legitimate businesses in the world. The mining as described is very different from "mining" as known on the stock exchange, and as known to the small investor who buys a share for 5c with the expectation of getting a 100 per cent. dividend; fake dividends, declared through juggling of accounts on the books of fake companies. In honest mining dividends are taken out of the ground. To quote from our esteemed contemporary: "A dividend is a dividend when it is earned from ore actually mined, and when the company's surplus is large enough to meet emergency expenses."

The subject is also important as drawing attention to the increased yield of low grade gold ores. The great bulk of the gold values of the world are in in this class, for example, the $4 grade of the Homestake and $2 or $3 grade of the Alaska Treadwell. The fact that a few of the gold mines of South Africa paid about $3,000,000 in dividends in the month of April of this year alone is conclusive proof of our statement, the yield per ton being less than $8.00.

The discovery of valuable metals in Northern Quebec and Ontario leads us to the belief that before long Canada's gold production may again mount to the high figures it attained seven or eight years ago, when the Yukon yield was at its maximum.

DIAMONDS.

There are but four regions where diamonds have been met with in the United States. These are, according to Mr. George F. Kunz of the United States Geographical Survey, (1) the Pacific Coast, chiefly along the western base of the Sierra Nevada, in the central counties of California, associated with gold in the cement gravels; (2) along the line of the moraine of the ancient ice sheet in Wisconsin, Michigan, Indiana and Ohio; these have been transported from an undiscovered source, presumably somewhere in Canada; (3) Kentucky and Tennessee; (4) the Atlantic States from Virginia to Alabama, chiefly along the eastern base of the Appalachians in what is known as the Piedmont region. The actual place of origin of diamonds is in all these cases unknown. Those of the Pacific Coast and the Atlantic States have been derived by erosion from the adjacent mountain ranges, but the original sources have never been discovered. Those of the northern drift have doubtless come from Dominion territory, and their exact source is entirely a matter of speculation. The few occurrences in Tennessee and Kentucky are not as yet definitely traceable, even in theory. All have been found in loose and superficial deposits, and all accidentally. Most of those in the Atlantic and Pacific regions have been met with in washing gold.

We Canadians have a special interest in these diamond discoveries in the drift region of the United States, as during the last four years they have been found in connection with gold washings of Brown and Morgan counties, in southern central Indiana. Mr. Kunz obtained a full series of specimens of the rocks found in the gold-bearing drift of that region and forwarded them to Ottawa with a view to tracing out, if possible, the source of the diamonds. These specimens were examined by Dr. A. E. Barlow, Mr. W. J. Wilson, and Prof. H. M. Ami, of the Geological Survey of Canada; Prof. W. G. Miller, Provincial Geologist of Ontario; Dr. G. A. Young, petrographer, and, subsequently, in more detail by Prof. Frank D. Adams, McGill University. These gentlemen, who will be recognized as specially qualified to judge owing to their intimate acquaintance with the geology of Quebec and Ontario, recognized these fragments as apparently identical with rocks familiar to them at various points in Northern Ontario. Especially marked was the prevalence of pieces and rolled pebbles of jasper and jaspilite, which are found associated most characteristically with the iron ores of Michipicoten and other iron ranges north of Lake Superior. Professor F. D. Adams made a still more detailed examination. In the thirty samples sent him there were two hundred specimens, each one of which was carefully examined and then divided into groups clearly definable. These groups and the percentages which they represent were as follows:—

No. 1 is represented by characteristic material, much of it evidently coarse pegmatite, rich in feldspar.

Nos. 3 and 4 are certainly, and Nos. 5 and 6 probably, from the iron ranges of the Huronian or Keewatin.

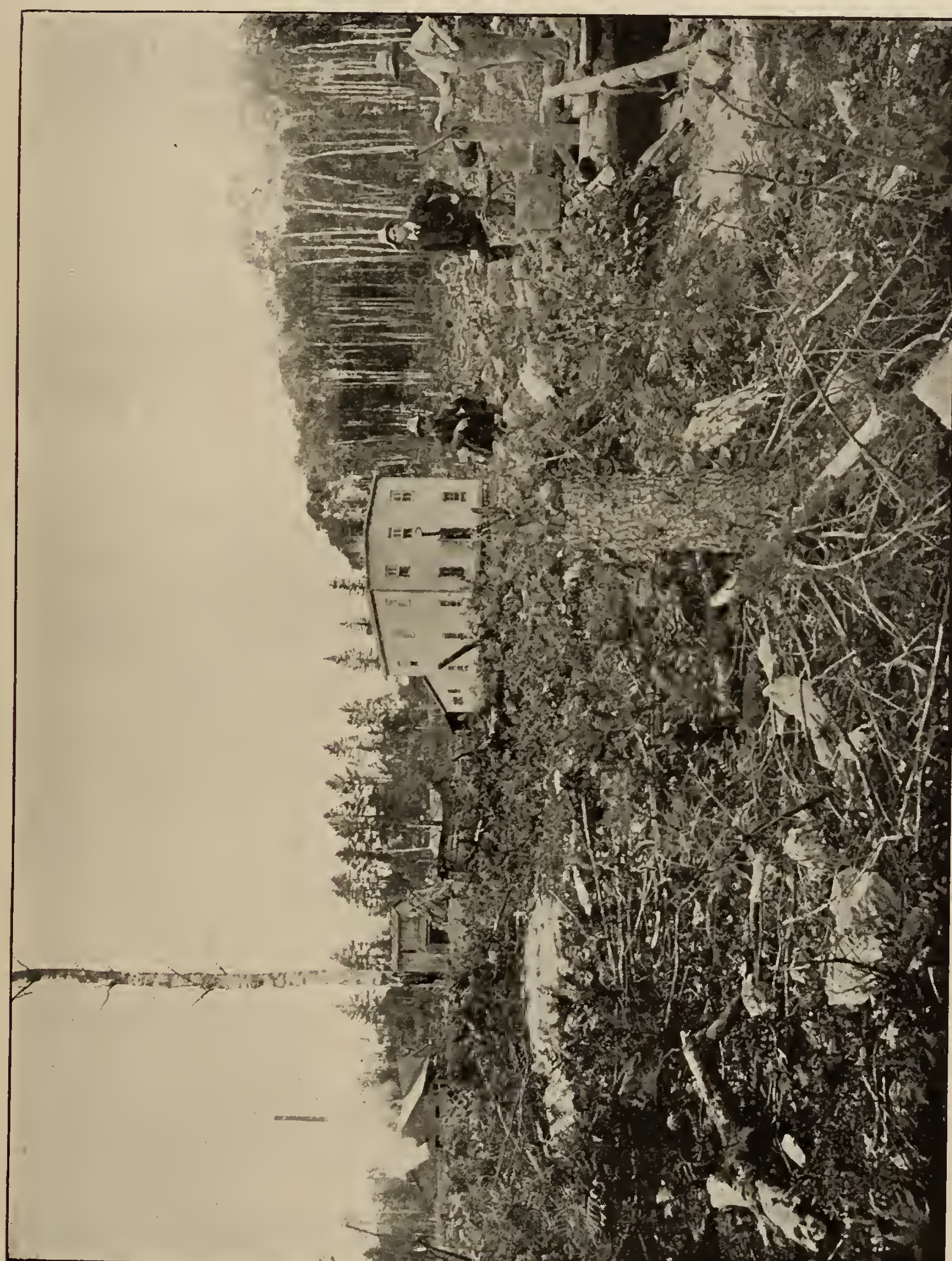
The pieces numbered 7 seem to be partly Keewenawan and partly Huronian, while those included under 8 are distinctly Paleozoic.

It thus appears that the portions decidedly referable to the iron ranges of the Huronian and Keewatin (Nos. 3 to 6, inclusive), make up nearly half of the whole material (49.4 per cent.), while the quartzite, No. 2 (29.8 per cent.), is largely Huronian. These rocks are widely developed north of the Great Lakes and at no great distance from them.

It is to be hoped that the careful instructions given by Dr. H. M. Ami to a hundred or more parties that have been surveying for the Transcontinental Railroad may bring forth good fruits. They were instructed how to search intelligently for diamonds and no doubt some of them have profited by the directions given to them. It is within the bounds of possibility that a diamond field may yet be found in Canada, and we think it would be a wise thing for the Geological Survey to issue such particulars of diamonds, their appearance in the rough and the tests therefor, as would enable prospectors, lumbermen, farmers and explorers to recognize these gems should they be so fortunate as to find them.

METEORITES.

Coming apparently from nothing and disappearing as mysteriously, now as silvery threads across the darkness and anon bursting forth in all the brilliancy of the noon-day sun, sometimes as silent visitants and at others outrivalling the thunder's roar, meteors and their progeny, meteorites, must have early excited the wonder of even primitive man. Of his notions regarding these phenomena we can have no accurate conception, but certain it is that they have furnished him with the basis of one of the earliest, if not the earliest, forms of idolatry. Whole religions and much mythic folk-lore have had their origin in the descent of bodies from the



Silver Queen Mine, Cobalt.

skies. Viewed sometimes as the forerunners of great national disaster and sometimes as the harbingers of unwonted prosperity, they have among various peoples and at different periods been treated on the one hand with a mixture of awe and contempt, and on the other raised to the dignity of divinities in themselves. According to the old Lithuanian mythology, at the birth of each infant a star is suspended in the heavens from a slender thread by the spinstress Werpeja; the star thus sheds forth its light while the child lives, but at the end of its earthly career the thread breaks and the light of its star is extinguished. Traces of the ancient reverence with which meteorites have been regarded are still to be found in the case of the Kaaba stone. This stone is built into the northwest corner of the Kaaba at Mecca, and despite the antiquity of its advent upon earth, is profoundly revered by all devout Moslems; its history is buried in tradition, but of its celestial origin there is no room for doubt. The Diana of the Ephesians and the Venus of old Paphos were primarily meteorites, and many others of the ancient divinities had an origin of this kind. At first the meteorite itself was regarded as a deity, but as the exigencies of time demanded it was made to serve as the headpiece to a statue of wood or stone fashioned in either human or animal form. The old Romans, at the very height of their civilization, were not proof against the worship of bodies that had come from the skies. The Ancyle was obtained from Attalus, king of Pergamus, about the year 204 B.C., and brought to Rome by Publius Scipio Nascia, and installed with an elaborate ceremony in a temple specially prepared for it; it had been worshipped for centuries at Pessinus under the name of Cybele, "the mother of gods," and was acquired by the Romans in accordance with an oracle which declared that its possession would assure stability and prosperity to the Roman Empire; this specimen has been looked for within recent years in the excavations about Rome, but the probability of its ever being found seems very remote indeed. A stone which fell at Emesa in Syria was brought to Rome by Antoninus (Heliogabalus) early in the 3rd century A.D., and for some time was made the object of a most disgusting worship. The chronicles of the Chinese government furnish us with the earliest records in historic times of the fall of bodies from the skies; these records date back to a time ten centuries before the birth of Christ; they are, however, made public only at the termination of each dynasty, and thus, though voluminous and teeming with information, are not made available with any great frequency. The worship of meteorites has not been confined to any particular continent or people; it has been practised by the unenlightened of all climes and times; in Africa the custom seems to have been widespread, many tribes maintaining a special order of priesthood in whose custody these messengers from the heavens were placed; in America many examples are to be found of this kind of worship; some of the old Mexican temples have held treasures in meteorites; the Octibbeha meteorite was found in an Indian grave; meteorites have also been found on the altars of some of those mysterious people, the moundbuilders, the remains of whose temples may still be seen in part of what is now the State of Ohio; for long ages, the Indians of the Saskatchewan worshipped an iron meteorite which had fallen at the head of Iron Creek; about the year 1869 this specimen was removed from its resting place and ultimately found its way into the collection of Victoria College, where it now remains; the Indians were loud in their wailings when they found that it had been removed, and their medicine-men were profuse in their predictions of the calamities that would befall the tribes of the Saskatchewan in consequence of the removal of their idol; this meteorite weighed about 386 pounds, and by a little stretch of the imagination the profile of an Indian's face may be clearly made out on the edge of it. A stone which fell near Ogi in Japan about 1730, and which came into the possession of the British Museum in 1883, was for long made the object of reverent attentions at annual festivities.

In view of the widespread interest which is now being manifested in the study of meteorites, the Canadian Geological Survey has for some time past been putting forth special efforts to trace the history of all Canadian specimens and likewise to augment the numbers in the collection either by exchange or purchase. Within the past few weeks five plaster models and two specimens—one of the latter being a new one and as yet undescribed—have been added to the collection, which now consists of three main masses, three fragments or sections and nine plaster models, and negotiations are in progress for the addition of others.

GEOLOGICAL SURVEY NOTES FROM COBALT MINING CAMP.

A visit to the famous Cobalt Mining Camp shows that the unhealthy conditions due to the "boom" of the past year are rapidly changing for the better, and that the camp is now settling down to a sane state of development and production. During the past year the area containing the silver-bearing veins has been only slightly enlarged, while the areas of cobalt-nickel veins have been extended considerably. From present indications there appears to be no great chance of wide-spread new discoveries of silver veins in this camp, except perhaps to the south, on the Gillies timber limit now controlled by the Ontario Government and to the northward in the southern portion of the township of Bucke where the thick covering of glacial drift makes prospecting slow and expensive.

The first break in the "boom" is said to have been due to the withdrawal from sale, by the Government, of the Gillies limit, thus greatly reducing the presumably rich area open to the prospectors; the second cause was the difficulty of making discoveries in the areas deeply covered with boulder clay, while the finishing touch was added by the refusal of the mining inspectors to pass any claim which did not show sufficient mineral to justify the presumption, that a workable mine would be developed on the claim. Of course there are still many persons going about Cobalt and Haileybury with the usual collection of mineral specimens in their pockets ready and anxious to show them to intending purchasers, but the time is past, never to return, when a slight tinge of cobalt bloom found on a claim made it worth thousands of dollars; the investor has now become wary and only risks his money in claims which have passed the inspector.

The miscellaneous floating population of the early spring, consisting largely of amateur prospectors and investors, has departed almost without exception, leaving only a law-abiding assemblage of miners and of those in legitimate trade, so that only the constantly recurring blasts from the surrounding mines show that Cobalt differs from the prosaic character of an ordinary new village of Ontario. The only cause for trouble at present is due to several parties prospecting on the same mining lot, all trenching for discovery veins, with equal rights in the eyes of the law. In these cases the party that has been at work for weeks digging unsuccessfully but hopefully, feels naturally sore at the intrusion of others, and threatened violence has been expressed in a number of instances of this description; luckily, whisky is absent, and "guns" are few, so that to date these bickerings have all ended in words.

The older claims are beginning to be systematically worked—almost every mine now has a shaft with the necessary steam hoisting and drilling plants. Shafts are being sunk and tunnels run, to block out and prove the mines, and a start is being made to recover from last season's dumps much of the valuable ore thrown aside in the hurry for rich returns. Milling plants are being introduced and the time will soon be passed when ore valued at hundreds of dollars a ton will be cast aside as of no consequence. Along with this change from open quarrying to shaft mining, owners are prospecting their claims for other veins hidden beneath the boulder clay and in this they are usually marvellously successful, many new veins being found by surface trenching. This method is so slow, costly, and otherwise unsatisfactory that an attempt is being made on one of the larger properties to move the surface dirt by a hydraulicing plant and deposit it in an adjoining lake. On some claims the veins uncovered by trenching are so numerous and close together that it is a question whether it would not be better to take out the entire rock mass rather than honeycomb the claim with a network of small tunnels following the irregular courses of the many veins.

In the shafts and borings no depths greater than 300 feet have been reached, but these all show a continuation of the rich ores in depth and so point to greater depths for profitable mining. The information obtained from the shafts and tunnels shows that the rich ores occur in zones or patches in the cobalt-nickel ores, but at present sufficient information has not been obtained to state whether these occurrences of the rich ores follow a general law or are of irregular formation.

No discoveries of new minerals have been lately found to add to the large number already discovered in the veins. Smaltite is the common ore in the greater number of the mines with the various other compounds of cobalt and nickel in changeable quantities. The silver usually occurs in the native state or as dyscrasite (an alloy of silver and antimony); it is also frequently found as argentite and more rarely as ruby silver. Native bismuth is found frequently but sparingly in many of the mines.

The future of Cobalt camp looks bright for several years to come, and there appears to be little doubt that continued development will lead to the discovery of many new veins, while the sinking of shafts will show a continuation of values in depth.

BEYOND THE CLEARINGS.

So little is known of the northern parts of the provinces of Quebec and Ontario, that the Blue Book issued by the Government, as to the resources of the country, between Quebec and Winnipeg, along the proposed route of the National Transcontinental Railway, possesses a value that is perhaps hardly realized by any but our geographers and engineers. This Blue Book was compiled from authentic sources by Dr. Henry M. Ami of the Geological Survey Department, Ottawa. The report deals with an area of 180,000 sq. miles, divided into sections averaging 100 miles in length, and taking in a belt of country 75 miles on each side of the proposed line of railway. For the sake of convenience, these sub-divisions are numbered in consecutive order from 1 to 12, beginning with the city of Quebec, and continuing in a westerly direction to Winnipeg. They were named as follows:—(1) Quebec Division, (2) Saint Maurice Division, (3) Upper Gatineau Division, (4) Upper Ottawa Division, (5) Abitibi Division, (6) Upper Moose or Mattagami Division, (7) Mamattawan Division, (8) Long Lake Division, (9) Nipigon Division, (10) Lake Saint

Joseph Division, (11) Lac Seul Division, (12) Lake of the Woods Division.

Quebec Division, No. 1.

The Quebec division includes the narrow flat lying and bordering the alluvial and marine plain of the St. Lawrence, north and north-west of which the Laurentide Hills raise their well-wooded and majestic heads in beauty and grandeur, presenting a bold front in their southern exposure. It is well known that these hills lose their rugged appearance to the north—the country resembling more a generally level plateau. The St. Maurice River offers a natural highway into that well-timbered and well-watered region, which could be easily taken advantage of in reaching the broad and more generally level country along the height of land.

This is typical Laurentian country; rounded hills and valleys, with lakes and rivers everywhere.

In a northwesterly direction from the city of Quebec it is not difficult to reach the St. Maurice. The Lake St. John Railway runs in that direction quite a distance, and from the point near Rivière à Pierre in a northwesterly direction towards La Tuque and Iroquois Chute. Thence to the height of land there are no obstacles of any account, a general level plateau is struck which can be followed in a westerly direction for 800 miles, not varying 200 ft. in that distance.

Timber is abundant.

The climate is identical with that of Quebec city.

Iron, mica, plumbago, and other Laurentian materials are found.

There are excellent water powers on all streams.

The St. Maurice valley can be easily reached and forms a natural highway towards the generally level tableland to the north.

There is a zone or belt of flat undulating and alluvial land consisting of sand and clay loam which occupies the Saint Lawrence valley proper.

To the north, the country is generally hilly. The Laurentian Hills present a bold front here as they do all along their southern border. In a northwesterly direction as well as north of the city of Quebec, the hilly character of the country obtains for a considerable stretch, nevertheless, it is a well-known fact that a more open and less distinctly rugged country occurs as we proceed towards the height of land.

Along a line drawn from the city of Quebec to James's Bay, when the height of land is crossed, a comparatively level plateau is reached where an easy grade can be obtained. All the reports consulted agree upon this point that there is a level tract of country from the headwaters of the Gatineau to Lake Mistassini. Between the city of Quebec and the height of land, the great valley or highway of the Saint Maurice river may be taken advantage of. The Laurentian Hills are not made up of continuous chains of hills which as a rule present barriers, but consist of innumerable bosses placed here and there, between which, on one side or the other, it is quite possible to obtain a valley suitable for a roadway or railroad line. The fact that the Saint Maurice river is navigable for upwards of seventy miles without interruption and forms a natural highway to the height of land, clearly points to the direction of least resistance, as well as easy grades.

St. Maurice Division, No. 2.

In his report for 1874-1875, printed by order of the Legislative Assembly, the Commissioner of Crown Lands of Quebec, Mr. H. G. Malhiot, describes the valley of the Saint Maurice as follows:—

"To give an idea of the importance of the valley of the St. Maurice and of the vast field which it offers to commerce, industry and colonization, it will suffice to state that the territory watered by the St. Maurice and its tributaries is 18,020 square miles in extent, and the greatest part of it is thickly wooded. Eight thousand and forty-five square miles of this forest are under license, producing a revenue of about $70,000 a year, and capable of producing much more. This territory contains about 3,000,000 acres of land fit for settlement. The river St. Maurice, one of the largest in the province, is navigable for a great part of its length, from the Grand Piles Falls to about twenty-eight miles from its mouth; and when the Piles railway now undertaken, and which will connect the navigable waters of the St. Maurice and the St. Lawrence, is constructed, it will afford to settlers and immigrants an easy route by which to reach the interior of this vast region."

Upper Gatineau Division, No. 3.

In ascending the Clear-Water River, a tributary of the St. Maurice through Pemscachie, Watoush, Fishing, and Clear-Water Lakes to the height of land portage, a distance of about 17 miles, the country bears the same level aspect as on Sandy Beach Lake. For nearly half this distance the woods have been burnt, considerable areas now producing only small cypresses about four or five feet high. Where the forest has not been burnt, the sandy soil produces a smaller growth of timber than on Sandy Beach Lake.

The river in this distance, to the height of land, rises only 131 feet, reaching 1,418 feet above the sea. The distance from the height of land down from Falls River, through Lake Normandin, Kakaskapstethiouisse, and Askatiche, to Lake Nikabau, is about 34 miles. For the whole of this distance the description given of the country along Clear-Water River is equally applicable. It presents the same alternation of green and burnt woods, as well as the comparatively level, barren, sandy soil. The height of Lake Nikaubau, is 1,266 feet above the sea, showing a fall 152 feet from the Height-of-Land.

The Upper Ottawa Division, No. 4.

The country is generally flat or an undulating plain, part of Hudson Bay basin. The southern portion hilly and rocky. Middle portion, through which the line traverses, is flat and gives easy grades, occasional ridges and hills.

Large areas of dry clay soil extend around the height of land. Although the district as a whole in its southern portion cannot be said to be suitable for agricultural purposes, still, in many places, considerable areas of good land are known to exist.

Silver, lead, zinc, copper and other minerals exist. Gold, gypsum, and lignite have also been discovered and recorded.

In this division water powers are numerous.

The Abitibi Division, No. 5.

Iron copper, magnetic iron pyrites and steatite are reported, and, inasmuch as the great Huronian belt of metalliferous rocks traverses this region further discoveries are anticipated.

White and red pine found over the whole region. On the north side of the height of land pine trees measure from eight to nine feet in circumference. White spruce, yellow birch, cedar, also tolerably abundant. Poplar, canoe birch, banskian pine, elm and ash are also reported, and sugar maple and aspen.

The whole country northward from the mouth of the Montreal River is pretty correctly described as a level clay plain with rocky hills protruding here and there through it. Mark the distinction between this region and the country south. Clay appears to be uniform throughout the whole region. Several acres of this clay soil are cultivated at the Hudson Bay Company's post at Abitibi. All the ordinary cereals cultivated on the St. Lawrence can be cultivated at Abitibi. Indian corn is grown in several localities near the head of Lake Temiscaming.

Upper Moose or Mattagami River Division, No. 6.

Fine agricultural land, clay and sandy loam forms part of great clay basin of Moose River, and its numerous tributaries, which take their rise near the C.P.R. line, north of lakes Huron and Superior, and even south of the line. The head-waters of the rivers in this division are well timbered, and the country may be described as an undulating, rolling plain, gently sloping towards James Bay.

Red and white pine, spruce, tamarack, white birch, poplar, and balsam, abound.

Is good for farming throughout the greater portion of the country. The hills are not very high. At Brunswick House, a Hudson Bay post, the soil is clay.

Coal as lignite, fine sand, china clay, and peat have been discovered and geologists report the occurrence of the mineral-bearing Huronian formation.

Dr. Bell writes:—"I am now enabled to demonstrate that an immense area of mineral-bearing Huronian rocks, the largest as yet known in the Dominion, runs northward from Lake Huron through the greater part of the distance lying between it and the area of unaltered rocks of the southwest part of James Bay; also that the Michipicoten belt of these rocks is much more extensive than had hitherto been supposed. Some deposits of economic minerals were discovered, and others which have been little known were examined. In the Moose River basin a remarkable set of wide spreading trap dykes was found to exist. The occurrence of Tertiary lignite on this river was not previously known to the public, although a few persons living in the country were aware of it. The flat lying rocks of this region had been previously represented on geological sketch-maps as continuing up the eastern side of James Bay, but I found this supposition to be erroneous."

Mamattawan Division, No. 7.

The country is generally a level plain, slightly inclined to the west. Easy grade. Practically level country.

The land low and swampy in places, needs drainage. Rolling land, heavily timbered.

Good spruce, tamarack, banksian pine, poplar, red pine, cedar, reported throughout this division, beside white birch, balm of gilead.

Inasmuch as the greater portion of this division is covered by good agricultural land and surface deposits mineral occurrences have not as yet been specially noted, but the Huronian mineral bearing rocks also crop up and may yield their quota of mineral species peculiar to that formation.

Long Lake Division, No. 8.

Partially a dissected plain. Fine agricultural land in numerous sections. Level and rolling country. Hilly and rocky in the southern portion. Flat and generally level along the projected line.

Abundant vegetation everywhere.

Tamarack, spruce, balsam, white birch, pine, poplar abound throughout this district. Hardwood in the southern portion and jack pine along the sandy stretches.

Two large areas of Huronian mineral-bearing rocks are known to occur in this division.

The Nepigon Division, No. 9.

The country is in part level and undulating and part rocky. The Nepigon region constitutes a dissected plane. Good agricultural land, clay soil and clay loam and sandy loam.

A little north of Lake Nepigon the country is heavily timbered with spruce, banksian pine, poplar, and balsam, with occasional birch, also tamarack.

The iron-bearing band occurs in this division and resembles the iron from the Michigan Ranges. Lignite occurs in beds of clay.

The climate of the Nepigon country seems to be well suited to agriculture. Farming has been successfully carried on at Nepigon House, Hudson Bay Company post.

Lake St. Joseph Division, No. 10.

Topographically, the region forms a part of a low, rocky, well-watered plateau. Except in a few cases the relief of the interior is rarely over fifty feet. The country is generally flat or very gently sloping.

Spruce, poplar, tamarack, with birch and banksian pine occur near Osnaburgh House, Hudson Bay Company's post.

The water bodies lie in shallow basins, and many of the streams are sluggish, being situated near the height of land and intersection of three watersheds.

Huronian mineral-bearing rocks are reported to occur in this division.

Lac Seul Division, No. 11.

Many of the islands and shores of the lakes are covered with clay and drift and other drift deposits. The drift area extends easterly to a considerable distance. Country is uniformly a level plateau, partly drift covered, with large areas of swampy country.

The forest growth consists principally of black spruce, poplar and white birch, with occasional red and white pine.

Active mining is in progress in this district. Gold locations are reported. Iron pyrites iron (occurring in a well marked iron belt), and other minerals peculiar to the Huronian.

Lake of the Woods Divisions, No. 12.

The country is generally rolling and covered with areas of sand, occasionally forming ridges. Lakes abound everywhere and swampy tracts of land. Better country than Rat Portage section to the south. The valley of the Winnipeg River would form an easy route towards Winnipeg, in which direction the country slopes gently.

Spruce and tamarack occur throughout the region.

Prospecting for gold and iron has been carried on vigorously for fifteen years, and considerable mining has resulted in numerous enterprises which bid fair to be of value.

The soil throughout wherever present is light and sandy. Numerous swamps or muskegs are present.

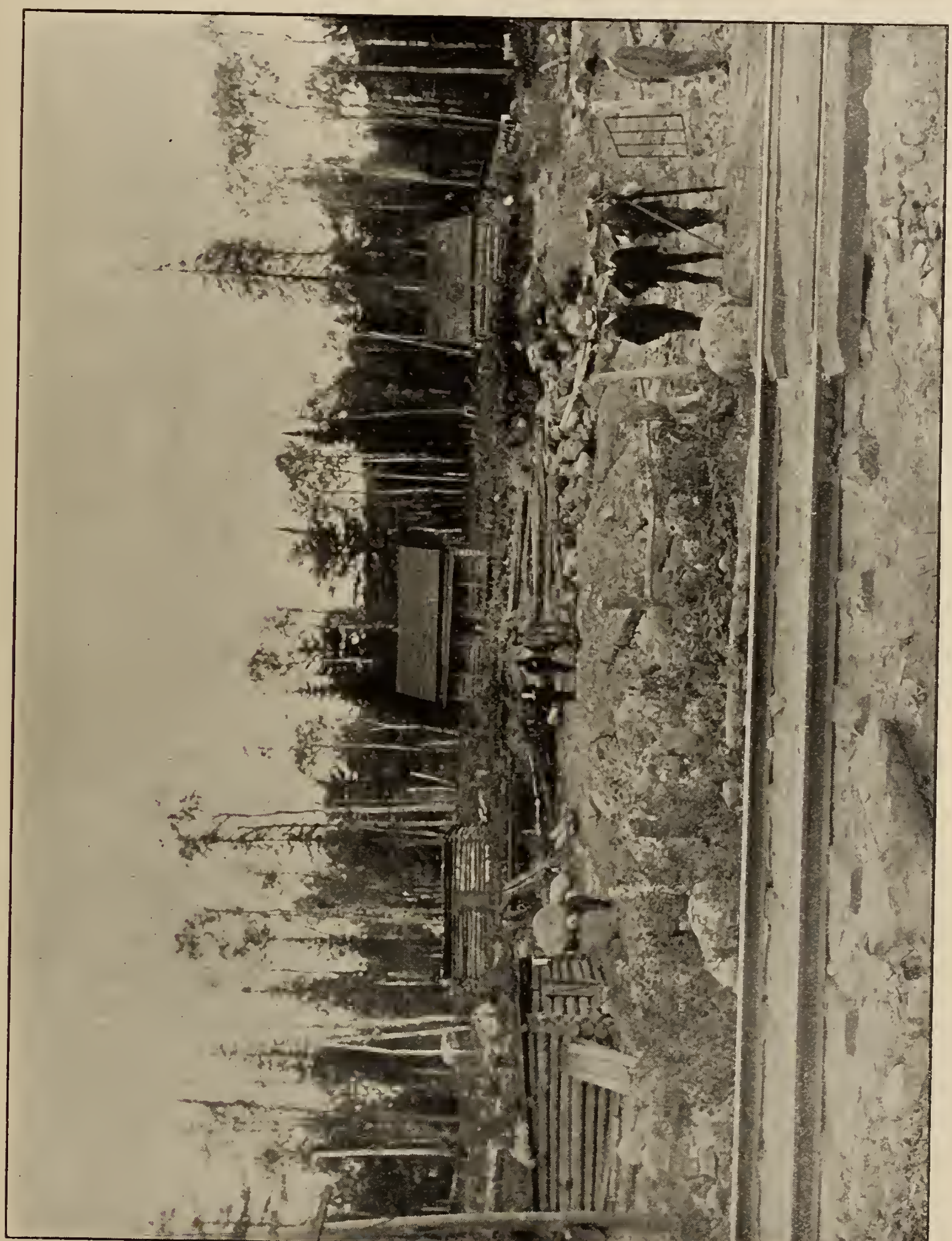
CYANIDE PLANTS AND THEIR EQUIPMENT.

Pamphlets that are issued by firms selling mining machinery are not always very impartial reading; generally they refer in more or less eulogistic tones to the particular products of the firm issuing them. Occasionally, however, one finds that manufacturers have got out of this groove and have put out something that is of general interest and more than a mere sales catalogue. One of the best that we have come across lately is a description of cyanide plants and their equipment put out by the Allis-Chalmers Company, whose Canadian representative is Allis-Chalmers-Bullock, Limited, of Montreal. The introduction to this pamphlet consists of thirteen pages written by a well known mining engineer who has superintended the operation of cyanide plants not only in the United States, but also in Australia and South Africa. Nearly all the classics on the cyanide process start with Elsner's equation and follow a certain well beaten path, so that the treatment of the subject varies but little, no matter who the writer may be. This course has been avoided and the stereotyped method abandoned by the writer to this publication, which should have more than ordinary interest for all who are interested in the extraction of gold from free milling ore. Moreover, it is non-technical and the mine-owner or operator can understand it almost as well as the mining engineer.

The cyanide process is based upon the principle that dilute solutions of cyanide of potassium will dissolve gold and silver under certain conditions, and, while there are limitations to its use, its application has been greatly broadened since the first few years following its introduction in the mining industry, until now the process is one of the most important known to metallurgy. It is particularly adapted to certain classes of ores, which, owing to their low grade character and other features, physical, chemical and mineralogical, are not treatable by other processes, at least on a commercial scale; such ores were, it seems, destined to remain in nature's keeping until the advent of this process, which gives promise of extension to such fields and such ores as were formerly never dreamed of by its most enthusiastic advocates. So it is that we now have a wet chemical process whose practical application is understood and whose position in metallurgy is not only firmly established but is actually threatening the very existence of other and older processes and in many places superseding them.

THE PROCESS INVOLVES FOUR DISTINCT OPERATIONS.

In the simplest application of the cyanide process ore undergoing treatment is first crushed to the proper degree of fineness, and then charged into leaching vats, where contact is had with a dilute



Cobalt Townsite Mine.

solution of cyanide of potassium. When the gold and silver is dissolved, the solution is drawn off the ore through a filter bed, thus clarifying it, and thence conducted to precipitating boxes or tanks (filled with zinc shavings), where the gold and silver is extracted and later recovered in the form of a marketable product or bullion. Thus it will be seen that the process consists essentially of four operations:

1. Preparation of the ore.
2. Dissolving of the precious metal contents by cyanide of potassium solution.
3. Precipitation of the dissolved gold and silver.
4. Recovery of the precipitated gold and silver.

DIFFERENT CYANIDE PROCESSES.

Our remarks so far have been made more particularly with reference to the straight cyanide process; that is, as originally devised. This process has survived nearly all attempts to replace it with something else, and in principle has undergone no changes. Many other so-called methods, which were only modifications of this well-known process, have been launched, tried and have disappeared. They differed from the original only in one thing, perhaps; as, for example, in the manner in which precipitation was effected, the zinc box extractor being replaced by some other means of precipitation; but it is noteworthy that the original process is used almost exclusively throughout the world, nor has its position ever been seriously threatened.

Bromo cyanidation has met with considerable success, but its application is restricted rather to certain sulphotelluride ores, and then its use would depend largely upon a comparison of cost of treatment by this method and the old method of roasting followed by plain cyanidation. Its success, however, has been remarkable in Western Australia where raw ores are successfully bromo cyanided. Its use involves fine grinding, the cost of which, plus the cost of bromo salts and royalties to the patentees, is to be considered.

Precipitation by means of zinc shavings has a fixed place in cyanidation, and no doubt gives greater general satisfaction than could be obtained through any other method proposed, such as precipitation on charcoal, by means of zinc fume, on lead in the electrolytic method, etc. There are instances where special conditions have favored precipitation but the successful issues have been rare.

VARIED METHODS OF PREPARING THE ORE FOR TREATMENT.

The preparation of the ore for cyanidation is accomplished in as many different ways as there are machines used for disintegrating, and the particular class of machinery best suited for any ore will depend upon the physical and mineralogical composition of the ore proposed for treatment.

Preliminary breaking of the ore in crushers or breakers is common to nearly every method of ore reduction, while grizzley bars find valuable use in relieving the crusher of unnecessary work.

After preliminary breaking, one ore may require wet crushing in the stamp battery, another a system of gradual or progressive crushing, by means of crushing rolls, either wet or dry, while certain ores must be crushed in the dry state and then roasted to prepare them for successful cyanide treatment. The degree of fineness to which an ore is to be crushed is a question requiring the most careful consideration and when once determined the method by which disintegration is to be effected is selected; one ore will be found to yield the maximum amount of gold and silver in the shortest time at the lowest cost when crushed to coarse size, such, for instance, as will pass a three mesh screen—and such ore would possess sufficient porosity to allow the solution of cyanide of potassium to penetrate and reach the gold and silver contained everywhere within the largest piece of ore; another ore might lack porosity entirely and will need grinding to such a degree of fineness as will insure contact of solution with the gold and silver.

The extent to which grinding will be carried is regulated, not so much by the amount of gold and silver that it will be possible to save by additional grinding, as by the net results attained, expressed in terms of costs, i.e., the process as a whole must not only be a metallurgical success but a commercially good enterprise, so that costs of achieving a desired end form a consideration of the greatest importance.

THE FIRST STEP.

The first step, that of preparing the ore for cyanide treatment, is one involving considerations that tax the cyanide chemist, the metallurgist and the manufacturer of milling machinery to the utmost, and it will be seen that if the preparation of the ore is not effected in the proper manner at the least cost, the process as a whole, and especially the chemical treatment of the ore, will not give the most satisfactory results.

ORE CRUSHING BY ROLLS.

In the treatment of certain ores, especially of low grade character, where the cost of special treatment of slimes would militate against a commercial success, the ore will be cyanided by the straight percolation method, the success of which will depend largely upon the absence of interfering slimes.

The production of slimes in crushing must be kept at a minimum; to this end crushing rolls are employed. Progressive or gradual disintegration, of the ore in conjunction with efficient screening is the method which produces the least slimes.

Ores are frequently cyanided at 20 or 30 mesh, and in such case a disintegration would be accomplished by preliminary breaking in a Gates Gyratory or other crushers, followed by passage of the material through a set of roughing rolls, the product of which would be screened, with the oversize being returned to same set of rolls and the undersize fed to a set of finishing rolls to be still further reduced in size, thus gradually disintegrating the ore from lumps to the required fineness. After each pass through a set of rolls it is desirable to remove by screening the particles which are fine enough, to prevent their further comminution. Sometimes the ore is made to pass through two, three or even four sets of rolls, as conditions demand.

There are many ores which are most successfully cyanided at the coarser meshes, such as two, three or four mesh. An approved method of crushing an ore to these coarse meshes is by preliminary breaking in a Gates Gyratory crusher, followed by secondary crushing in a Gates fine Gyratory crusher, and finishing in one set of rolls, with screening interposed advantageously.

Crushing rolls and the intelligent use of efficient screening devices, such as revolving or vibrating screens, or both, form an important part in the preparation of an ore that should never be underestimated, even by those who favor stamp battery crushing or other machinery for disintegration. Many ores absolutely demand crushing by rolls and consequently the skilled laboratory investigator will invariably weigh the merits of roll crushing as applied to any ore under examination.

In using rolls either wet or dry crushing may be practiced.

The limit as to fineness in crushing by rolls is usually accepted as 30 mesh in mill practice, with 40 mesh as an exception.

STAMP BATTERY IN CONNECTION WITH THE CYANIDE PROCESS.

The stamp battery has proved a great success in crushing ore for cyanide treatment notwithstanding the fact that it was formerly considered that successful cyanidation depended upon dry crushing. Wet crushing in this was has become a prominent feature in cyanide operations the world over; while in some cases the ore is crushed dry in the stamp battery most generally the work is done in the wet method.

Crushing in dilute cyanide solution is practiced considerably and is claimed to be a favorable factor in treatment, reducing time required and tending to increase the saving.

Where amalgamation is practiced in combination with cyanidation, the stamp battery is ideal for crushing, and with the progress made in the treatment of slimes, the production of the latter is not so much considered a menace to cyanide treatment. Amalgamation is responsible for a goodly share of the combined saving, and this feature is not to be ignored, especially when it is considered that the results obtained from the single operation of cyaniding refractory ores, raw, might not always be sufficient to justify metallurgical treatment.

THE USE OF HUNTINGTON MILLS.

The Huntington Mill is particularly well adapted for crushing for cyanide treatment, contributes to low working costs and satisfactory savings. It is used extensively for regrinding work, and in addition is very suitable for reducing the product of rolls to size required for leaching treatment. Various sizes of screens may be used, depending upon conditions to be met, ranging from comparatively coarse to very fine.

CHILIAN MILLS.

For high efficiency and economy of operating the Chilian mill has earned the praise of practical mining men.

In cyanide practice this type of mill is sometimes used for reducing ores to 20, 30 or 40 mesh sizes. The mill is suitable for even much finer comminution, being employed frequently in the production of material all of which will pass a screen of 100 meshes per linear inch.

It is claimed for it, that the product of a Chilian mill contains less metal, abraded from the grinding surfaces of the machine, than is the case with any other type of mill, a consideration of importance, more especially when certain chemical processes are used.

FINE GRINDING.

In the early life of the cyanide process the presence of finely comminuted ore in the leaching vat gave rise to all the difficulties characterizing unleachable ores and the inability to cope successfully with those difficulties at the time, made it imperative that the proportion of fines and slimes approach the minimum possible with any system of crushing, but with the development of the process, and the discovery of successful methods of treating slimes, the same fear of the production of slimes no longer occurs. The fact is the metallurgist now is often confronted with the problem of installing machinery that will accomplish one of the very things he formerly had to avoid—fine grinding.

TUBE AND BALL MILLS.

There are a number of different machines used for fine grinding ore, among them being Tube and Ball Mills, both of which have gained prominence in connection with cyanidation.

In West Australia, in the treatment of raw ores, the method comprehends, in many mills, preliminary breaking in Gates Gyratory crushers, followed by the stamp battery, with subsequent amalgamation and concentration, the tailings of the concentrators being separated into three classes, namely: sands for treatment in leaching vats, slimes for treatment in agitators, and comparatively coarse material which is reground in tube mills, so that all would pass a screen having 100 holes per lineal inch or even more, the product approaching slimes and being cyanided with the other slimes previously separated for treatment, in agitators. For this fine grinding, tube mills have given eminent satisfaction.

Another method which is used involves preliminary crushing in Gates Gyratory breakers, the product of which is fed to Ball Mills, working dry and arranged to reduce the material to a state of fines, all of which will pass a 20 mesh screen. The product of the Ball Mill in this case is roasted and subjected to cyanide and other treatment. There are other mills used in the same field, for producing material, but so far none of them have reached the same high state of efficiency as the Tube and Ball Mills.

ROASTING ORES FOR CYANIDATION.

Roasting for cyanidation is a question requiring the consideration of practical experienced cyanide experts familiar with every detail of the art, and it may be recorded that no branch of metallurgy is so exacting, so far as roasting is concerned, as cyanidation.

Cyanide treatment demands that the roast shall convert the ore into such a state as will aid cyanidation, and in nowise hinder it. If the roasting has not been properly done, certain sulphates of base metals present may remain in the roasted product to destroy cyanide of potassium to such an extent as to not only interfere materially with the dissolving of gold and silver but actually defeat the commercial end sought, by reason of the cost of the cyanide consumed.

The roast most generally given an ore preliminary to cyanide treatment is an oxidizing one, while in the case of treating a purely argentiferous ore a chloridizing roast is giving great promise as a valuable aid to cyanidation.

Roasting affects the physical condition of an ore, promoting porosity, as well as changing its chemical constitution; the resultant product should be such as to make a satisfactory saving of gold and silver by cyanide of potassium a matter of easy attainment. Roasting, then, necessarily done at a cost not prohibitive, has to be effected in a furnace built to meet the needs of a cyanide roast, which means, among other things, that the heat must be applied to the ore in its passage through the furnace with particular regard to the chemistry of the operation

An oxidizing roast must be carried to the point of "dead" roasting, i.e., to as complete an elimination of sulphur as is possible. Most of the oxidation will occur at a dull red heat, and at this stage more or less sulphates of the base metals will form, to decompose which the temperature must be raised to a bright red heat. This higher temperature must be imparted to the ore at the critical moment, and at a point in the furnace removed from that where the oxidizing temperature prevails. This higher heat should be of sufficient intensity only for the decomposition of the sulphates, a still greater heat being liable to cause fusion, in the presence of certain metals.

It might be far better to forego roasting entirely and to treat the ore in a raw or unroasted state than to subject an imperfectly roasted ore to cyanide treatment with consequent prejudicial effect on extraction and prohibitive cost for cyanide of potassium.

BEGINNING THE PROCESS OF CYANIDING.

After the ore is crushed for treatment the important operation of "cyaniding" begins, and if the ore requires no classification, and has been crushed dry, it is at once charged into leaching vats for cyanide treatment. Some ores, however, are so physically made up that when charged into a leaching vat the cyanide solution will not percolate with sufficent rapidity through them to give a profitable saving, owing to the great length of time required for their treatment and in certain cases the passage of the solution is nil; in the earlier life of the process some of these ores were abandoned as unsuitable for treatment and then it was that Cyanogen was said to have been dethroned. The cyanide process was condemned in so many instances, through reasons of this and other kinds, that a rapidly growing faith received considerable shaking, but the believers remained true and the real believers were men of great metallurgical attainment, who, supported by the efforts of the machinery manufacturers, brushed aside the difficulty referred to, as well as many others of greater and lesser importance. As a result, it is now known that if an ore on account of its slimy nature defies treatment by the percolation method, other means are available for its successful cyanidation.

SLIMES NO LONGER FEARED.

In some sections of the world, with many ores, fineness of the crushed product is desired rather than avoided and the suggestion that certain classes of ore be finely ground—reduced to a state of division closely approaching slime—has been received with considerable favor by experts whose efforts have been directed toward the development of cyanide treatment of unroasted ores. However, ores containing both coarse and the regular gradations in sizes down to slimes present difficulties in treatment which render their classification necessary;

the ore is separated into "sands" and slimes, prior to cyanidation, the former receiving treatment in the leaching vats and the latter being subjected to agitation with cyanide solution in agitating tanks, followed by separation of the precious metal-bearing solution from the slimes, usually by either decantation or filter press methods.

SEPARATION OF SANDS AND SLIMES.

Where the slimes exist in prejudicial proportion, as regards percolation, and agitation must form a part of the operations and classification into "sands" and slimes is necessary, the work must be blended in with the task of eliminating the excess water and the charging of the leaching vats, so that the correct proportion of slime will be removed from the "sands" for agitation treatment and no "sands" will reach the agitators. These, when working properly, achieve their purpose with gold ores usually in the maximum time of sixteen hours, and commonly in less time, so that any coarse ore particle finding its way to the agitators would not yield its gold and silver in the allotted time and thus the saving would be impaired.

The instance is not uncommon where the separation of "sands" and slimes is so faulty as to partially reverse the conditions needed for good extraction—where the leaching vat receives an undue proportion of slimes, and "sands" are diverted to the slimes plant, with the result that the respective steps of cyanidation suffer to a degree which clouds the enterprise as a commercial proposition. Such a condition, if the equipment used is what it should be, demands correction at the hands of a cyanide man whose mastery of the details of cyanidation is complete. Classifiers, V-shaped, conical and other shapes find use in this important work, with, perhaps, the spitzkasten employed most extensively.

METHODS OF CHARGING LEACHING VATS.

The methods used for charging leaching vats may be classified as "direct" and "indirect" filling, and a selection of the kind to be employed will invariably be based upon the nature of the crushed ore, the respective merits of the methods for that particular ore and cost of accomplishement, together with results in the way of recovery obtained.

DIRECT FILLING.

Direct filling involves the use of some sort of pulp distributor or a method of distributing the pulp in such a manner as to place the pulp into the leaching vat so that the different sized particles of ore will occupy definitely related positions and thus insure the uniform passage of the cyanide solution through the mass. Imperfect filling leads to the deposition of material some portions of which resist the passage of solution more than others, and the cyanide solution follows the lines of least resistance, with the result that gold and silver is dissolved only from the ore in spots, thus accounting for low extraction.

Among the appliances used for direct filling in the wet, one of the most successful is that known as the Butters and Mein's Distributor.

There are other distributors and other methods used for direct filling, many of which are giving satisfaction.

INDIRECT FILLING.

Indirect filling comprehends the separation of a crushed product into sands and slimes and water, the settlement of the sands so separated in boxes or tanks suited for the purpose, from which the material is usually removed by hand to the leaching vat, in which the cyanide treatment is to occur.

Both methods of filling have advantages.

FILLING WHEN DRY CRUSHING IS USED.

Where dry crushing is practiced, the material is charged into leaching vats direct by any of the well known means, such as tramming in ore cars or by conveying belts. In dry filling every precautionary measure should be taken to avoid packing of the ore in the vat, which has the effect of retarding percolation, and leads to an uneven passage of solution through the body of the ore.

LEACHING PROCESS.

In the simple application of the cyanide process, in the case of dry crushing, the raw or roasted ore is charged into leaching vats for treatment with cyanide solution. Either at some point in the crushing operation or when the vats are being filled lime is added for the purpose of neutralizing the acidity of the ore. Sometimes an alkaline wash is given the ore in the vat previous to introduction of cyanide solution.

Cyanide solution is introduced into vat either by upward percolation from below the filter bed, or introduced on the top of the ore, or use is made of both methods. Care is exercised that the ore will take the solution without channelling.

After thorough saturation of dry ore, the solution being allowed to stand about two inches above the top of the carefully levelled ore, percolation may be commenced at once, if maceration is not desirable. The working solution is turned on to the top of the ore and the solution filtering downward through the mass is allowed to drain to gold tanks, whence it is eventually conducted to extractors for precipitation of the gold and silver contents.

Various strengths of solution are employed to dissolve the gold and silver, depending upon the ore, while the time of treatment also varies. The quantity of cyanide solution applied is also variable.

Finally wash water is used to displace as far as practicable the cyanide solution remaining with the mass of ore. Necessarily, this wash must be restricted and is usually such as will preserve the "balance" of solution in the mill.

Solutions are manipulated in accordance with the best judgment of the man in charge and in the way best calculated to yield the highest extraction.

In the treatment of "sands," the only difference in the method just described would be due to filling, the ore being already wet, and percolation with cyanide solution is commenced as soon as the vat is filled and partially drained of the crushing water or solution.

DOUBLE TREATMENT.

Leaching vats are arranged in many plants so that a charge of ore which has been subjected to leaching treatment for a number of days in one vat, may be drained of its solution and transferred to another vat for further cyanide treatment. This is known as double treatment, and its use with many ores undoubtedly results in higher extractions.

The transfer from one vat to another affords aeration of the material, besides rearranging all the particles of ore. The benefit is apparent after a few days' treatment in the second vat.

The vats in which first treatment is accorded are generally superimposed above the second treatment vats. In some plants they are arranged on the same level and the transfer of ore from one vat to another effected by means of mechanical excavators and conveying belts.

THE TREATMENT OF SLIMES.

In the treatment of slimes, after the slimes have been separated from the sands, they are thickened in "V" shaped boxes or conical bottom tanks, when they are conducted to agitators, there receiving a charge of lime or caustic soda to neutralize acidity and subjected to agitation with cyanide solution.

AGITATION.

Agitation may be accomplished in several ways but the most prominent methods in use employ mechanical stirrers or centrifugal pumps, or a combination of both. The centrifugal pump is a later adaptation of the agitation process but has proven well suited to the purpose

When mechanical stirrers are used, the slimes are agitated by means of revolving arms fitted in tanks, for a suitable period, when the pulp is allowed to drain from the agitator into a well from which it is pumped direct to filter presses in which the gold and silver bearing solution is separated, after which the solution drawn away from the presses may be clarified and then conducted to gold storage tanks, whence it is allowed to flow to precipitating boxes.

MONTEJUSES.

Montejuses are sometimes used for charging filter presses in place of pumps and by many are considered the more satisfactory. The Montejuses make use of air pressure for raising and forcing the pulp into the presses.

AGITATION BY MEANS OF CENTRIFUGAL PUMPS.

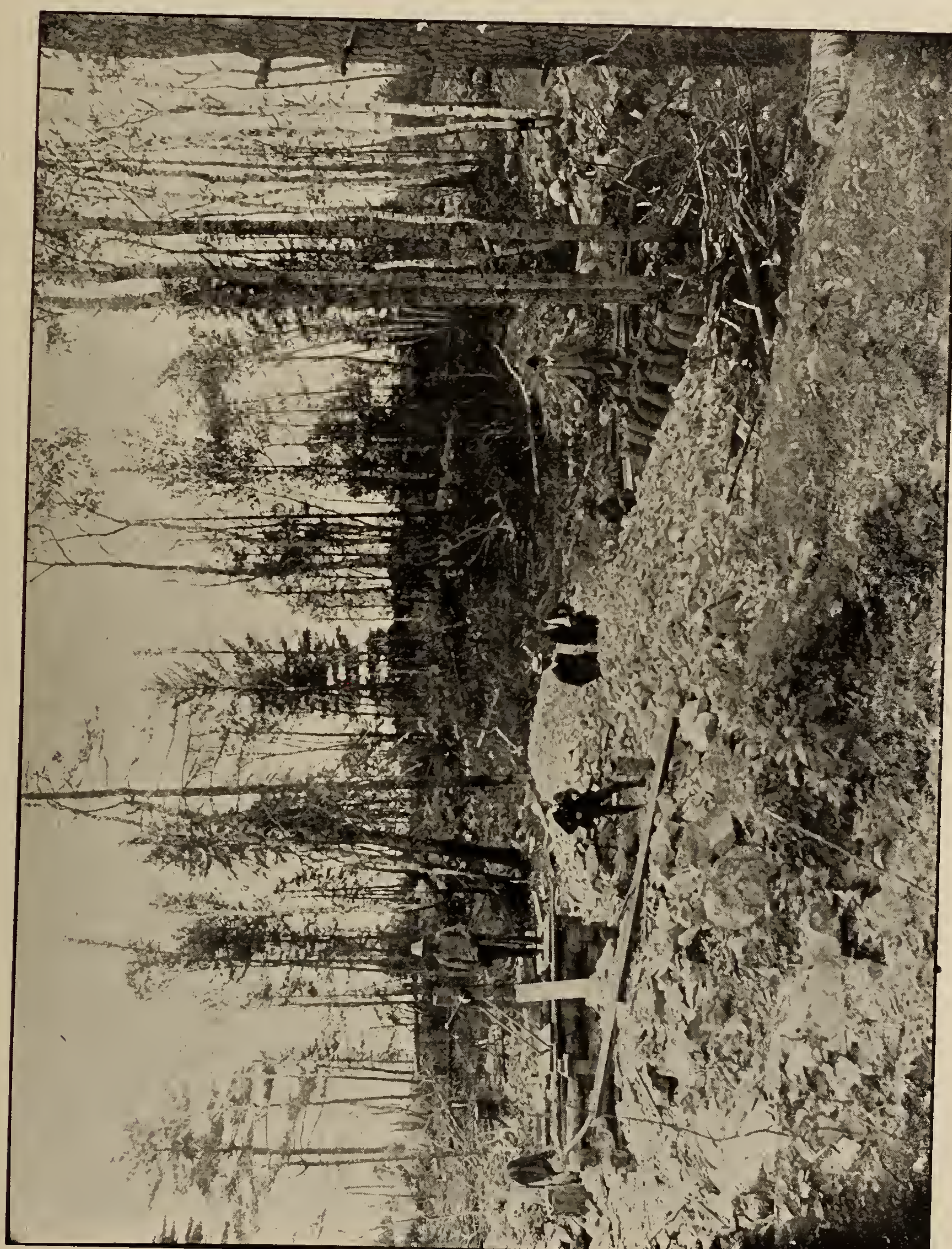
If agitation is effected with a centrifugal pump, the agitation vat is usually constructed with a conical bottom with suitable slope. An orifice is situated near the bottom through which the material may be finally discharged. A centrifugal pump is so connected with the tank that the pulp may be drawn from most any position inside the tank, passed through the pump and elevated to the height of the tank, returning to the same tank at a point close to the bottom, thus establishing a circulation which promotes continued disturbance of every particle of slime and cyanide solution in the charge undergoing treatment, ensuring dissolving of gold and silver in the shortest time possible. After agitation is complete the contents of the agitator are transferred to a similar vat used for decantation.

DECANTATION.

In the decantation tank the solid matter is allowed to settle and the solution is decanted, usually by means of a decanting pipe or hose attached to a float, and conducted thence to the extractor house for precipitation. The decantation vat is then recharged with precipitated cyanide solution or water and the centrifugal pump is put to work and agitation commenced for the purpose of intimately mixing the slimes with the new charge of cyanide solution or water, when settlement is again allowed to occur. This operation is repeated until a satisfactory separation of the gold and silver bearing solution and the slimes has been effected when the residue is discharged and runs to waste.

FILTER PRESSING—ITS SUCCESS IN WEST AUSTRALIA.

The filter press is an adaptation in cyanide work, having been successfully used in other industries. After a series of repeated failures, in almost all of which its attempted use was abandoned, West Australian interests renewed the work of experimenting with, finally, gratifying results. The ores of that section when treated raw require fine grinding to the point of sliming, and the successful work of the filter press makes it possible to practice such grinding.



Cobalt Townsite Mine—No. 2 Shaft.

ITS ADAPTABILITY TO OTHER FIELDS.

The filter press is not restricted to use with sulpho-telluride ores nor confined in employment to West Australia. There are many ores in various sections of the United States and other countries not now being treated owing to certain physical properties which interfere. Many of these could be made to yield their gold and silver contents by cyanide treatment embracing filter pressing.

OTHER METHODS OF TREATING SLIMES.

The filter press as generally known is intermittent in its operation. The cost of installation and expenses of operating sometimes prohibit its use.

Continuous filter pressing in self-discharging filter presses, in combination with replacement leaching therein, is receiving the attention of eminent men in the metallurgical profession. It is claimed that such a method offers all the advantages and scope afforded by leaching tank work besides giving the same economy and higher extraction.

Other methods have been proposed for slime treatment, and tried. One worthy of note made use of a basket of canvas-covered filter frames, which was mechanically immersed in a tank containing the slimes which had been agitated with cyanide solution. Filtration was caused by means of a vacuum. The suction caused the slimes to collect on the filter surfaces in layers or cakes. The apparatus with adhering slimes was subsequently transferred to another tank for washing of the slimes.

Efficiency and economy were claimed for the method. However, the suggestion that the method be improved to make of it a continuous process possessed merit and it is understood that progress is being made in this direction.

Methods other than, as well as, those described herein lend justification for the hope that slimes may eventually be treated less laboriously, at lower working costs and with higher extraction.

PRECIPITATION OF GOLD AND SILVER.

The chemistry of precipitation is very complex, and the chemical reactions that occur in the zinc box are so varied and some of them so obscure and yet so vital to the undertaking that the cyanide chemist is frequently called upon for the exercise of the highest skill.

The manufacturer views the problem more particularly from a mechanical standpoint, thus aiding the chemist through the production of zinc boxes best suited to meet the requirements of the process, minimizing some of the difficulties encountered in precipitation, as well as facilitating easy dressing of boxes with zinc shavings and making the periodical cleanup a matter of great simplicity.

RECOVERY OF PRECIPITATED GOLD AND SILVER.

Various methods of cleaning up zinc extractors and reducing the precipitates to bullion form are in use, and the practice employed at any plant always conforms with the particular ideas held by the man in charge, although some steps in the operation are common to all methods.

Periodically, the precipitates, with more or less zinc are removed from the zinc extractors for treatment, preparatory to final reduction by fire. Usually dilute sulphuric acid is used to dissolve the zinc with which the gold and silver is associated, after which the concentrated mass is conducted to a small filter press for thorough washing to remove as far as practicable the acid and soluble sulphates. Compressed air is then used to dry the precipitates.

The dried precipitates are roasted in a muffle furnace to eliminate remaining sulphates of the base metals, more especially zinc sulphates.

The roasted precipitates are then fluxed, economically, with borax, silica and bicarbonate of soda, and charged into crusibles for fire reduction. In the resulting fusion a slag should be produced that will give a good separation of the bullion.

The recovered bullion will be contaminated with more or less zinc and other base metals, but is usually fine enough to be satisfactory. Refining of the bullion bars on the premises beyond the purification that would result from remelting once or twice, is a question that would depend upon the conditions imposed by the mints and penalties exacted for impurities in the marketed bullion bars.

There are instances where the precipitates are sold direct, without any attempt at reduction in the cyanide plant, to reputable custom refineries. In some of these instances the cyanide managements prefer to forego the operation of producing bullion, often for the reason of difficulties encountered in refining.

Generally, however, the gold and silver extracted in cyanide treatment is reduced to bullion form upon the premises.

IMPORTANCE OF FIRST-CLASS CLEAN-UP EQUIPMENT.

The appliances used in the clean up and bullion department are of such importance that a high grade quality of equipment is excellent insurance against loss of gold and silver.

The slag and old crucibles can be worked over economically on the premises and much of the gold and silver bullion existing therewith recovered. With this end in view, the slag and other material may be crushed and screened and that which passes through the screen treated upon a concentrating table for the recovery of the bullion. The tailings from this operation are generally sold to the smelter.

DISPOSITION OF TAILINGS.

Tailings may be removed from leaching vats by sluicing and this method is practiced invariably when the tailings are to be treated upon concentrating tables for the recovery of some of the precious values that have not been saved by cyanide—such as sulphurets, etc. Sluicing will always find favor where water is abundant, and there is no objection to the tailings leaving the mill site, and where such objection does exist, in some instances, the tailings are impounded within a dam, this rendering sluicing possible.

Conditions for impounding tailings are not always favorable, water for sluicing not always available and in such cases the tailings may be removed from the leaching vats by shovelling by hand or with the use of mechanical excavators. The tailings are either removed in cars or by conveying belts. In a flat topography the conveying belt has the additional advantage of enabling the stacking of the tailings in heaps of considerable height, a task that is performed economically as well.

The residues of filter presses may be handled in any of the ways described.

It is common practice in some mining districts to utilize the cyanide tailings for "back filling" of stopes in the mines, thus turning the refuse material to valuable account, at the same time overcoming the difficulties due to limited storage space on the surface of the property.

COMBINED TREATMENT METHODS.

The cyanide process is frequently used in combination with amalgamation and concentration. The order in which the various processes will be arranged for the whole treatment will depend largely upon the character of the ore.

In some mining districts the ore is first amalgamated and then passed over concentrating tables to remove the sulphurets as concentrates for separate treatment, or shipment to the market for sale, while the tailings of the concentrators are subjected to cyanide treatment.

Another method provides for amalgamation, followed by cyanidation, to be finally followed by concentration of the cyanide tailings.

Amalgamation and cyanidation form a combination most suitable and economical for certain ores, while in the case of dry crushing, with some ores, cyanidation and concentration are used to advantage.

Combined treatment by Lixiviation with hyposulphite to recover the silver and cyanidation to extract the gold contents of ores emenable to such treatment has very strong advocates in the metallurgical field.

Wherever metallurgical conditions demand and net results justify combined treatment will continue to find employment.

CORRESPONDENCE.

THE NIPISSING MINES COMPANY.

Editor, The Canadian Mining Review,
Montreal.

Dear Sir,—

When the July issue of your paper, to which I am a subscriber, reached here I was out of the city, but on my return, on reading the same over, I came across the article on page 4 relating to the Nipissing Mines Company, and a number of the statements therein contained were so at variance with facts known to me that I thought it well to forward the paper to Mr. Earle. Had such an article appeared in some papers we would not have paid any attention to it, but an article of that character appearing in a publication such as that of the Canadian Mining Review we cannot let the same pass, because it is calculated to do a great harm and injustice to those interested in the mines, and I may say that there are a number of Canadians very heavily interested in the same. I will go over certain of the matters which require correction.

1. Mr. Earle did not become interested in these properties for the benefit of himself and some members of the International Company. The fact is that he acted solely for himself when he dealt with the previous owners of these mines, and no person in any way interested in the International Nickel Company had any interest whatsoever in the same and had no knowledge whatever of his dealings. This fact has already been established in evidence given in an action which was brought by the Government with regard to a small portion of the property, which action has since been dismissed. It is quite true that certain persons interested in the International Nickel Company as soon as the value of the mines began to be known approached Mr. Earle and obtained from him an interest in the company, but the Nipissing Mines Company is in no way connected or in any sense governed by the International Nickel Company. I think it was quite reasonable and good business judgment on the part of Mr. Earle to part with a portion of his interest in this property to one gentleman who is a shareholder in the International Nickel Company and whom he wished to interest on account of his wide experience and successful career in practical mining.

2. With regard to your criticism of the flotation of the company, such criticism is in no way warranted by the facts. The capital of the company is $12,000,000 but only $6,000,000 thereof was issued in connection with this property and of that you will remember about a million was in cold cash, leaving the properties themselves at practically five million. Last year, as you are no doubt aware, there was a net surplus from mining on a very small portion of the property of over a million, and I, therefore, cannot understand how you can say that it was unreasonable to expect five millions more to be taken out or even several times that amount. The general opinion among experts and men most qualified to know is that the flotation is most conservative. In a word, during one year and from about five per cent. of the territory owned by the company, and at less than fifty feet from the surface, the net profits were almost twenty per cent. of the total issued capital.

3. You make the statement that it is a known fact that at least four of the veins have completely disappeared at a depth of forty feet or less, and the experience of several of the deposits that increased depth has been accompanied by diminished values. The fact is that every vein operated with the exception of perhaps one small one is still being operated to a depth of between sixty and seventy feet with practically the same results as were obtained within a few feet from the surface. It is quite true that at the surface for some few feet, say from three to six feet throughout the camp, that the general experience is that the richest ores occur, but from that point down to where the veins have been worked the results have been practically the same and are to-day good paying veins.

I believe that your desire as editor of the paper you represent is to give to the public facts and I must, therefore, ask you to take the trouble to verify the statements which I have made and to check the statements which you made in your paper and when you have done so then give the facts in your paper to the public.

I understand that Dr. A. P. Low, Mr. T. W. Gibson and Professor W. G. Miller are advertised as special contributors to the Canadian Mining Review. They are familiar with the developments in this camp and we are quite content that they should go over the property and satisfy themselves as to the statements which I am making. If for any reason they do not wish to do that for you, then appoint some experienced expert who is independent of all other mines in the camp and let him report to you the conditions. The Nipissing Mines Company have nothing to conceal. Any statements that they have made are believed to be conservative and all we would ask from you in your paper is fair treatment, and I am sure that you will gladly correct statements which are erroneous in your paper and which have no doubt been supplied to you from an interested source. What I would propose is that when you have investigated the facts you submit the statement to me which you are prepared to publish and I will let you know whether the same is in accordance with the facts or not. Please let me know by return mail what you are prepared to do in this matter, because you can understand that we cannot allow to go unchallenged the statements made in your paper.

Yours truly,

D. FASKEN.

Toronto, Aug. 4, 1906.

[We print Mr. Fasken's letter in criticism of the article on the Nipissing Company appearing in our July issue, and as Mr. Fasken's letter speaks for itself we need make little comment.

As to our statements being at variance with facts, we think Mr. Fasken is mistaken, and has misread our language. Whether Mr. Earle was entirely alone when he acquired the territory is immaterial, as he writes that subsequently certain shareholders of the International Nickel acquired interests.

Our criticism of the flotation is but an expression of our own views; we repeat that to expect a return of so large a capital as $12,000,000, with adequate interest, is an improbable expectation, although we admit that the property has been very remunerative.

We regret that Mr. Fasken has taken our article as incorrect; if any statements therein are not true nor fair we shall be glad to make the necessary corrections upon proof of our mistatements.—Editor.]

B.C. LEAD PRODUCTION.

Editor, Canadian Mining Review,—

Until the lead tonnage can be obtained there can be no large reductions in smelting charges such as have occurred during the past decade in copper reduction, and until capital is invested there can be no proper development of the mines. It is from lack of development, and the presence of zinc, that the lead mines of B.C. are suffering. For the price of lead has so soared that it is now beyond the bounty figure and the silver quotations are higher than they have been for years past. But the low price of lead, and of silver for years has led the lead miners to neglect development, shipping whenever an opportunity was seen to net a little money. This is not the case with all of the mines, of course, but it certainly is with many. But now that better prices have come, and that there is a smelter to which zinc ores can be sent, effective separators which can separate the lead and the zinc, and thus render them both of commercial value, the question naturally occurs, why are not these mines proceeding with their development? Many are, but even in these cases the process is slow; many are not, they require capital. If the same amount of capital were expended upon the lead-silver properties that is and has been expended upon the copper-gold, there would be an equally good showing. But even without capital the country will get along, though results will not be so immediately apparent.

ALFRED W. DYER.

THE ROSSLAND DISTRICT.

Mr. R. W. Brock, of the Geological Survey, is the author of Preliminary Report, No. 939, on the Rossland Mining District, recently issued by the Geological Survey. In it he says:

Situation and Topography.

"Rossland is situated in the Trail Creek Mining Division of the West Kootenay district, Province of British Columbia, about six miles west of the Columbia river, and five miles north of the International Boundary line. It lies in the central portion of the Western Cordillera, in what has been called its Gold, or Columbian, range of mountains. To the east of the Columbia river, and separated from the Gold range by the Columbia valley, is the Selkirk system. The Gold range, or Columbian mountains, are, as a rule, less lofty and alpine than the Selkirks and in the vicinity of Rossland rarely exceed 7,500 feet in altitude. Here, all the hills below 6,000 feet have easy, flowing outlines, the inequalities of detail having been erased by the Cordilleran ice-sheet. The camp occupies the head waters of Trail creek, which flows east to the Columbia, and the head-waters of Little Sheep creek, which flows southward to join the Columbia below the boundary line. To the west of Little Sheep creek is Record mountain ridge, about 7,000 feet in elevation, forming a local divide. On its slopes Trail creek probably had its rise before these waters were captured by the headward growth of Little Sheep creek. This creek has now notched the transverse ridge from Record mountain, which separates Trail creek from Stoney creek on the north, thereby severing Red mountain (5,150 feet), from Mt. Roberts (6,450 feet), a shoulder of Record mountain. A second gulch to the east of Red mountain cuts it off from Monte Christo and C. and K. mountain, the continuation of this transverse ridge, and leaves Red mountain as a prominent dome. South of Trail creek are Lake Mt. (5,410 feet) and Look-Out mountain (4,420 feet). As a rule, the slopes are gentle, rising, on an average, about 1,500 or 2,000 feet in the mile. Roads may be run almost anywhere. The slopes were formerly well forested, but the demands of the mines and towns, and forest fires have largely denuded the hill sides of their timber. The climate is excellent. The summers are moderately warm and dry, with cool nights, and the winter climate is equable, the thermometer remaining remarkably steady, only a few degrees below freezing. The snowfall is heavy, but the clear air and sunshine and the absence of wind furnish an ideal winter. On the north side of Trail creek and almost at its head, perched on the slopes of Red and Monte Christo mountains, is the substantial city of Rossland, which for natural situation and general characteristics will rival any mining camp in the west. It commands a view of Trail Creek gulch and the Columbia valley 2,000 feet below, of the Selkirk mountains beyond, and of the ranges in northern Washington and Idaho. The elevation of the main street, Columbia avenue, is about 3,410 feet above the sea. The town is well built and is provided with a complete system of water works and drainage, local and long distance telephone, telegraphs, express companies, churches, schools, daily papers, board of trade banks, etc., and all the industries required in a mining and self-supporting community. Ample power for all mining and industrial purposes and light is furnished by electricity, generated at Bonnington falls, on Kootenay river. Two lines of railways connect the camp with the outside world. The Columbian & Western Railway joins it with the smelter town of

Trail, on the Columbia river, and with Robson, Nelson and Boundary district points. At Robson connection is made with Arrow Lake steamers, for the Canadian Pacific Railway main line, and at Nelson with Crow's Nest Pass branch. The Red Mountain Railway unites Rossland with Northport, Wash., 18 miles distant, where the Le Roi smelter is located, which point the Spokane Falls and Northern Railway connects with Spokane. The Kootenay district is remarkably well adapted for gardening and fruit raising, and the camp is well supplied with fruit and vegetables.

History.

"Although lead was discovered on Kootenay Lake (Blue Bell Mine) in the early twenties and was used as a source of lead for bullets by the Hudson's Bay Company, mining in West Kootenay is of recent growth. In the early sixties, a few hardy prospectors came northward, attracted by the rich placers of the Cariboo, and tested and worked some of the local streams for gold. In 1865 the Dewdney trail was completed, from Hope, on the Fraser river, to the placers of Wild Horse and other East Kootenay creeks, passing close by the site of Rossland down Trail creek. In the eighties, some claims were staked in the Boundary district; in 1883, at Ainsworth on Kootenay Lake, and in 1886, rich ore was discovered on Toad mountain, near Nelson. In 1887 the news of this discovery had attracted prospectors, and a trading post was established at Nelson. These discoveries started prospectors along the Dewdney trail, on the lookout for lode ores. The first claim located was the Lily May, on the trail itself. It was discovered in 1887 and located in 1889.

"Although the gossan of Red mountain had attracted the attention of the earlier travellers, along the Dewdney trail, some of whom, as Nelse Demers, had done a little work on it, the values were too low to warrant lode mining in a wilderness with its costly transportation, and development; placer mining, naturally, absorbed their interest. It was not until 1890 that claims were located on the lodes which were to create the city of Rossland and to bring southern British Columbia prominently before the mining and commercial world.

"In the summer of 1890, Bourjois and Morris, who were working on the Lily May, crossed over to Red mountain and located in one day the Le Roi, Centre Star, War Eagle, Idaho and Virginia. These claims were recorded at Nelson, the Le Roi being given to E. S. Topping for paying the $12.50 recording fees. He secured specimens and went to Spokane, interesting some business men of that town in the Le Roi, and the development of the camp began. The news of the strike brought prospectors, and the Josie, and most of the other claims whose names became so familiar, were located shortly after the first discovery—many in the month.

"Development was for the first few years slow, and the prospects of the camp uncertain. Lack of transportation and the financial panic of 1893 were the chief deterrent factors that nearly wrecked the fortunes of the camp. The first ore sent out of the camp was a small lot in 1891, which was packed to the Columbia river and thence shipped to an American smelter. In 1893, a waggon road having been constructed to Trail, on the Columbia, about 700 tons were despatched. The results were sufficiently reassuring to justify the erection of machinery, and with improved facilities, 1,856 tons of ore, shipped in 1894, returned $75,510. During the summer the Geological Survey, through Mr. R. G. McConnell, made a reconaissance survey of the camp. Several of the more important properties were bonded for considerable sums and development was begun in earnest. The following year, the young camp received marked attention. The population rose from 300 to 3,000; railroad and smelting facilities were projected, and from this time forward, developments were rapid. The smelter at Trail, and a tramway to connect it with Rossland and the mines, were begun in October, 1895, by Aug. Heinze, of Butte, and the first furnace was blown in the following February. In 1896 the Red Mountain Railway connecting Rossland with the Spokane Falls and Northern Railway at Northport, was completed. Then came the inevitable wild boom. The evil effects of a boom are not confined solely to the thousands of dollars squandered in worthless property, the losses sustained by the innocents, and the damaged reputation of the district, but they are manifest in careless work on deserving claims, in a rash expenditure that may for some time survive the boom; in a loss of interest in properties of merit that only require additional work to demonstrate their worth; and in a tendency to maintain prohibitive prices on promising prospects by owners who have purchased during the period of inflation and are not prepared to accept a serious loss, or by owners who, once having experienced the sensation of being millionaires, are loath to accept present conditions, but to prefer to speculate on the improbabilities of the future. Rossland has been called on to pay in full all the penalties attaching to a boom. The phenomenal rise in the value of Le Roi stock, the dividends declared by this company and the War Eagle, and the sale of the latter, to Toronto capitalists, for the reported sum of $700,000, produced a feeling of buoyancy that afforded every opportunity to the unprincipled boomster and the amateur mining magnate, the public for the time being cheerfully swallowed whatever was offered. The inevitable slump followed.

"In 1897 Rossland had an estimated population of 6,000 and was incorporated as a city. A broad gauge railway was built from Trail to Robson, giving better connection with the Canadian Pacific Railway than was afforded by river navigation along this rapid stretch of the Columbia. Stronger companies were formed to take over and develop promising prospects. In particular, the British American Corporation purchased the Josie, Nickel Plate, Great Western, Poorman, West Le Roi, Josie, No. 1, and Columbia-Kootenay mines. Development work had yielded most promising results. The Le Roi having completed its contract for 75,000 tons with the Trail smelter, erected its own smelter at Northport. In 1898 the Canadian Pacific Railway purchased the Trail smelter and railway from Heinze, and immediately made an important reduction in smelting charges. The British American Corporation secured the Le Roi mine and smelter by purchasing the stock at a price which was said to represent nearly $4,000,000 for the property. The Centre Star was purchased by Toronto capitalists for $2,000,000 cash. The construction of the Crow's Nest branch of the Canadian Pacific built through the Crow's Nest coal fields to Kootenay Lake, was an important event for the camp. It meant cheaper and better fuel and coke, and a consequent reduction in cost of ore production and treatment. These reductions brought about a large increase in ore tonnage, with a corresponding diminution in the grade of ore mined. Large plants with the most improved machinery for the economical working of the mines, were installed or planned, and operations on a large scale were projected. The construction of the West Kootenay Power Company's plant at Bonnington Falls, 32 miles distant, was another important evnt. Electric power was now available for the Trail smelter and the Rossland mines, although full use has not been made by the mines of this most convenient and economical form of power. At the close of 1899, the reputation of Rossland suffered from the sudden collapse in the price of War Eagle stock. This stock had been run up to a wholly unwarranted point, and was held in the hope that new machinery would permit an increased output, with a resultant advance in the stock. Unfortunately the machinery proved a failure, and the stock dropped. A general desire to realize followed and brought about a collapse, with a consequent loss of faith in the camp. In 1901, Rossland again received a set-back, this time in the form of labor troubles, which closed up the mines for a part of the year. These difficulties were amicably adjusted, but the evil effects of such troubles in discouraging investments are not quickly effaced. By 1902 the mines had resumed their normal operations and on a more business-like basis than before. Although the great number, size and value of the ore shoots in these mines have been proved, and it is known that much lower grade ore can now be profitably worked, this has so far not had the effect that might be expected in encouraging the search for other pay shoots and new veins outside the area already developed. Experiments in concentration were commenced in 1903 and are still being made, and serious efforts are being made to obtain the greatest possible profit per ton of ore.

"The development and progress of mining is reflected in the following table of production:

	Tonnage. (long tons.)	Smelter returns.	Value. per ton.
1894	1,856	$ 75,510	$40.69
1895	19,693	702,457	35.67
1896	38,075	1,243,360	32.65
1897	68,804	2,097,280	30.48
1898	111,282	2,470,811	22.20
1899	172,665	3,229,086	18.70
1900	217,636	2,739,300	12.59
1901	283,360	4,621,299	16.31
1902	329,534	4,893,395	14.85
1903	360,786	4,255,958	11.80
1904	312,991	3,760,886	12.01
1905 (estimated)	295,589	3,750,000	12.70
Total	2,212,271	$33,839,342	$15.25

"Shipments by mines to December 31, 1905 (estimated):

Le Roi	1,220,475
Centre Star	417,529
War Eagle	357,814
Le Roi No. 2	173,035
Jumbo	28,422
Iron Mask	17,655
Rossland-Kootenay	12,878
Rossland-Gt. Western	12,331
Velvet-Portland	7,751
Spitzee	6,709
White Bear	5,973
Giant	4,344
I. X. L.	3,500
Evening Star	1,500
Monte Christo	400
Miscellaneous	1,200

"The development work in the four leading mines is now in the neighborhood of 24 miles, and is at present advancing at the rate of about four miles per annum."

(To be Continued.)

THE PLACERS OF CARIBOO.

Among the various parts of the Province of British Columbia which are now attracting the attention of investors none seems to have a brighter outlook than Cariboo—the district which in the first place attracted settlers to the province, says the Cariboo correspondent of the Victoria Daily Colonist.

The vast fields of placer gold are again coming into prominence, and promise to exceed in returns by the use of the improved facilities of the present day the harvests which were gathered in by individual miners in the early days.

The advent of the Guggenheim Exploration Company to the Cariboo district is said to be attended with most important results. It is useless to attempt to estimate the advantages which the province will derive from the introduction of a firm with such world-wide fame as that of the Guggenheims.

In addition to the Cariboo Hydraulic Mines, in which the Guggenheims became so deeply interested last winter, the firm has recently acquired the control of two large groups of hydraulic mines on the Quesnel river.

These include the Spanish Creek group, fronting on the south side of the north fork of the Quesnel river east of Spanish Creek. There are in this group eight placer mining leases.

In addition there is also a large area on the north side of the main Quesnel river about four miles west of Quesnel Forks. This latter group includes the Maud Hydraulic, the Homestake, and others, making up in all 18 hydraulic leases of 80 acres each.

These two groups have been turned over to the Bullion Gold Mining Hydraulic Company, organized for this express purpose.

In order to work these properties there will be water supplies provided for independent of that which will be furnished for the Cariboo Hydraulic Mines. The water supply will be taken from Black Bear creek, Sailors' creek, Goose creek, and Cariboo lake. Involved in this scheme will be about 50 miles of canal. This will be 18 feet wide and 5 feet deep, which will be capable of delivering 5,000 miners' inches for each group.

Mr. J. B. Hobson, the efficient manager of these mines as well as of the Cariboo Hydraulic, has just returned from Cariboo. He was accompanied on the trip to that district by James A. Macdonnell, the railway contractor, who has been engaged on the building of the Nicola railway branch, and J. S. Gzowski, Jr., a well-known engineer.

As a result of their visit a contract has been let for the fifteen miles of canal which is to be provided for the supplying of water for the Cariboo Hydraulic Mines, which were recently purchased and turned over to the Cariboo Gold Mining Company, organized by the Guggenheim Exploration Company. The water will be taken from Spanish Lake by this canal, which will be 18 feet wide by 5 feet in depth. It likewise will be capable of delivering 5,000 miners' inches continuously.

When these canals are all completed there will thus be under the control of the Guggenheims three mines, each having 5,000 inches of water available daily for the washing of gold.

Messrs. Macdonnell and Gzowski will push the work forward, and already there have been ordered two steam traction excavating shovels to be used on the work. These are on their way from the East now, and will be put at work at once.

There are now 250 men engaged by the company building roads between Bullion and the line of the Spanish Creek canal. A bridge 800 feet long has already been constructed across the south fork of the Quesnel river at the outlet of Quesnel Lake. This is built across the crest of the Golden river canal dam.

The latest improvements in the way of gravitation trains, etc., to be used in the handling of lumber, etc., at a lower cost than at present are being installed at the old Cariboo Hydraulic Mines. It will thus be seen that all is activity in connection with the Cariboo Hydraulic in preparation of the new order of things connected with the installation of an adequate water supply.

The mining company will put in the steel pipe required in connection with the scheme. There will be required about 8,000 feet of 40-inch pipe to deliver the Spanish Creek water to the mines. This will be placed across the south fork of the Quesnel river to connect with the ditches on the south side. Another inverted syphon of steel pipe will be utilized to carry the water across Coquiette Pass. The contractors expect to have about six miles of the canal completed before the close of the present season.

Work on the canal system for the Spanish Creek and Maud groups will be commenced early next season. There is, therefore, assured a very large expenditure of money in the Cariboo in installing the plants. The operations afterwards extending over three groups and continuing throughout the whole of the open season, will mean the employment of a large staff of men and a material increase of the mineral output of the province.

But the Guggenheims are not the only capitalists engaged in developing their properties in the district. Others have been attracted by the latent wealth of the country, and are preparing to extract the golden harvest from the placer fields. Among those who are doing excellent work is Howard Du Bois and family of Philadelphia. Mrs. Du Bois and family are spending the summer in Victoria, while he is actively engaged in furthering his projects in Cariboo. He has interested a company of capitalists in Philadelphia and Pittsburg in a large hydraulic mining property at Twenty-Mile-Creek, on the south side of the main Quesnel river, at Twenty-Mile-Creek, about 20 miles west of Quesnel Forks. Mr. Du Bois is at work with a large force of men exploring the route for a canal.

The secretary of the Slough Creek Company has issued the following notice from the London office to the shareholders: "I beg to inform you that the engines which have been purchased to double the output of water from the mine have now been shipped to the property. The drain tunnel which is being driven with the object of taking any water from the upper gravels has been completed for about 1,500 feet. It is intended to continue this tunnel for another 1,000 feet for the purpose of intercepting any water from the upper part of the valley and so reducing the possibility of this water finding its way to the lower or gold-bearing gravel. This will leave the increased pumping plant free to deal with the water in the gold-bearing gravel, which should thus be more quickly pumped dry."

REWARDED FOR BEING GOOD.

We publish, herewith, reproductions of the gold medal awarded the Canadian Mining Review by the Commissioners of the Louisiana Purchase Exposition, for excellence of printing and production.

In the composition of the obverse of the medal are shown two figures, one of which, Columbia, tall and stately, is about to envelop the youthful maiden by her side, typifying the Louisiana Territory, in the flag of the stars and stripes, thus receiving her into the sisterhood of States. The other figure is depicted in the act of divesting herself of the cloak of France, symbolized in the emblem of Napoleon, the busy bee, embroidered thereon. In the background is shown the rising sun, the dawn of a new era of progress to the nation.

Obverse of the Medal.

The reverse of the medal shows an architectural tablet bearing an inscription giving the grade of the medal. Below the tablet are two dolphins symbolizing our eastern and western boundaries, the whole surmounted by an American Eagle, spreading his wings from ocean to ocean.

On the gold medal there are three distinct corners, each containing a wreath encircling a monogram or emblem, and each of these wreaths is surrounded by fourteen stars, representing the Louisiana Purchase States and Territories. On the Grand Prize design there is the same number of stars in the upper field of the shield, and there are thirteen bars in the lower field, representing the original States. On the design of the silver medal the artist has used the cross of the Order of Saint Louis.

Reverse of the Medal.

The medal was designed by Adolph A. Weinman. The design was approved by a committee composed of J. Q. A. Ward, Daniel C. French and Augustus St. Gaudens.

The dies were engraved and the medals struck by the United States Government Mint at Philadelphia.

INTERNATIONAL GEOLOGICAL COMMISSION.

BULLETIN NUMBER I.

The Commission Recognizes the Following Succession on the Hastings Road.

PNEUMATOLITIC SURFACE EXHALATIONS.

"The soul of the Magma."

1. Oxtail Soup.
2. Mock Turtle Soup.
3. Mulligatawny Soup.

The Commission found all these to be stamiferous.

Belt of Cementation.

The same original material may assume very varied forms under the influence of Thermal Metamorphism (see R. Van Hise—A Treatise on Metamorphism, p. 16,-294).

4. Ham and Eggs.
5. Ham and no Eggs.

If the former is rusty it is to be referred to the Grenville Series (A. C. Spencer).

6. Bacon.

Recent analyses by Hoffmann have shown that this contains the molecule B_aO, probably in the form of B_a CO_n — thus bringing out the close relation of this "Etage" with the igneous intrusions of the Rocky Mountain province, as shown by the work of U. S. Washington.

7. Scrambled Eggs.

This bed shows undoubted evidence of mashing.

8. Baked Beans.

Frequently a source of natural gas.—(Barlow).

9. Kippered Herring.
10. Chicken.

"Alas! my poor brother."

11. Tongue.

This is an intrusive apophysis.

12. Hard Tack.

Water does not circulate below this horizon, cementation in this being complete and recrystallization well advanced.

Zone of Flow.

13. Cheese.

This shows microbic segregation (compare Cushing "An Investigation into the damnifed gneisses of the Adirondacks.")

14. Dough Boys.

Closely allied to the Thanet gabbro. Shown by recent investigation to have a high modulus of Elasticity (E) combined with a very low modulus of Shear (C).

15. Cherry Pie.

This although possessing a red streak is undoubtedly pyrite.

16. Non-Cherry Pie.

17. Marmalade.

Rang I.—Keilerose. Sub-rang II.—Dundeease.

18. Tea and Coffee.

19. Moxie.

20. Ice Cream Soda.

This stratum is wanting in the Hastings district, but the committee have reason to belive that it is well developed in the Adirondack area.

21. Cigars.—Cigarettes.—Pipes.

The internal pressure is here so great that the critical point is past and bodies pass into a condition of gas.

INTERNATIONAL MINING CONFERENCE.

In connection with the Third International Colliery Exhibition recently held at the Royal Agricultural Hall, a representative gathering of delegates from mining and allied institutions in different parts of the world was entertained at luncheon by Mr. H. Greville Montgomery, M.P., the proprietor of the Exhibition. The delegates had been appointed to consider the advisability or otherwise of organizing an International Mining Conference to discuss subjects of international interest, especially the unification of statistics, the prevention of accidents, and technical mining matters generally. Amongst the delegates entertained were T. H. Holland, F.R.S., president of the Mining and Geological Society of India, and director of the Geological Survey of India; H. M. Ridge, representing the Australasian Institute of Mining Engineers; and Dr. Juengst and Herr Trippe, representing the Mining Association of Westphalia. Other gentlemen present were Colonel Yorke, R.E., and W. Russell, C.B., secretary of the recent Royal Commission on Coal Supplies, and invitations had been accepted by (amongst others) Lord Allerton, chairman of the recent Royal Commission on Coal Supplies, Sir Lees Knowles, Bart., president of the Institution of Mining Engineers, and Thos. Ratcliffe Ellis, secretary of the Mining Association of Great Britain, who were prevented, at the last moment, attending.

It was unanimously resolved to hold an International Mining Conference in connection with the Fourth International Colliery Exhibition in 1908, and it was further resolved that an organizing committee be at once elected, consisting of the following gentlemen, with power to add to their number:—

J. C. Cadman. President of the North Staffordshire Institute of Mining Engineers (Delegate).

Professor S. Herbert Cox, Delegate of the British Association.

William Cullen, Delegate of the Chemical, Metallurgical, and Mining Society of South Africa.

Professor Dunstan, Director of the Imperial Institute.

W. B. Esson, President of the Civil and Mechanical Engineers' Society (Delegate).

Professor Gowland, Delegate of the British Science Guild.

E. M. Hann, Past-President of the South Wales Institute of Engineers (Delegate).

T. H. Holland, F.R.S., President of the Geological and Mining Society of India (Delegate) and Director of the Geological Survey of India.

James Heppell Marr, Delegate of the Institute of Civil Engineers of Ireland.

T. W. Mitchell, President of the Midland Institute of Mining Engineers (Delegate).

W. H. Patchell, Vice-President of the Institute of Electrical Engineers (Delegate).

H. M. Ridge, Delegate of the Australasian Institute of Mining Engineers.

W. Rowley, Delegate of the Yorkshire Geological Society.

W. Russell, C.B.

Dr. Juengst.

Herr Trippe.

with H. Greville Montgomery, M.P., as Chairman, and Allan Greenwell as Secretary.

Promises of representation and assistance have also been received, amongst many others, from the Directeur-Général des Mines, Belgium; Comité Central des Houillères de France; Association des Ingénieurs sortis de l'Ecole de Liège; and the Société de l'Industrie Minérale, St. Etienne.

Letters of approbation have been received from H. Cunynghame, C.B., Assistant Under Secretary of State, Home Department, Edmund J. Garwood, Secretary of the Geological Society of London, on behalf of the Council, Dr. J. J. H. Teall, Geological Survey of the United Kingdom, and Dr. Horne, Geological Survey of Scotland.

All communications should be addressed to the Secretary at the offices (provisional) of the Conference, 30-31, Furnival Street, Holborn, London, E.C.

THE OUTLOOK FOR SILVER.

The uniform steadiness and comparatively high level that have been maintained in the price of silver during the closing months of last year and onward to the present time are without a parallel since 1896, when the average price of bar silver for the year worked out at 30¾d per oz. In that year Russia indulged in an extensive coinage of silver, and the price at one time rose as high as 31 9-16d per oz. From that date, however, prices experienced a steady downward movement, varied by brief rallies, which have redeemed the movement from an uninterrupted decline, but nevertheless sufficiently persistent to almost justify the description on balance as continuous up to the year 1903. The nadir in values was reached in November, 1902, when bar silver was quoted at 21 11-16d per oz. In the following year large purchases on behalf of the Indian Government rescued the price from the abyss to which it had fallen, and, subject to fluctuations from time to time, the tendency has since been gradually upward, until by the end of February of the present year it had touched 30 13-16d per oz. Therefore, between November, 1902, and February, 1906, silver on balance had risen 9½d per oz. in value.

The maintenance of silver at the present level of prices, which has now extended over a period of six months, is due mainly to the buying on behalf of the Indian Government, and also to some large purchases on French account. The consumption by India during this period has been very large. During the current year the exports to India have amounted in value to about five and a half millions sterling, as compared with about two and a half-millions sterling for the corresponding period of 1905.

With the figures of the past two years in evidence it would hardly be safe to anticipate a continuance of this large increase did we not bear in mind the strong hoarding instincts of the native Indian, and the fact that the Indian Government continues in the market is evidence that the present demands are not yet satisfied. How long that demand will last, it is impossible to say, and of course it may be suspended at any time; but there are at present no indications of it, and while the requirements of the Indian Government remain unsatisfied they will continue in the market, and consequently support the price of the white metal. Any cessation of that demand will, of course, cause the price to give way; unless other demands arise simultaneously with the present Indian requirements a further rise in the price of silver would probably result.

The question now is, What is likely to be Russia's requirements in the near future? With the completion of the forthcoming loan it is not unreasonable to expect that that country will be a large purchaser of silver for a considerable time, and this is what the market is anticipating. In that event, it is natural also to anticipate that there will be a further increase in the price of bar silver. No doubt this will be the result, given the buying on the part of the Indian Government does not fall off; but that is just what the best informed authorities on the subject are anticipating may happen, in which event it is a moot point whether the present price can be maintained. So far indications point to a slight reaction from that cause, but its probable effect may be fully neutralized by purchases in other directions, not only for Russia, but also for France, which is regarded as a likely large purchaser when the Russian loan is disposed of.—London Financier.

ABOUT PROSPECTORS.

A man may be an expert as a salesman, a wonder at a lathe, or a phenomenon at a plow or a threshing machine, but as a prospector without a full and complete knowledge of rock formation he is as helpless as a babe. The uninformed man fancies to himself that the silver is lying on the ground ready to be picked up by anybody, and all he has to do is simply go into the bush and find it. This picture may seem extravagant but in Cobalt and vicinity it is true to life. All manner of men are here, fixed up in shoe packs and conceit who are wandering through the bush who do not know the difference between lower Huronian formation and granite. They have heard that silver veins make their abode in cracks in the rocks, so to them it does not matter whether the crack is in syenite or limestone; they devote their energies to probing every crack that shows its nose. That geologists have devoted years of patient study and exploration in order to definitely locate minerals and give their experience and observation to the public, this amateur prospector may never have known, or if heard of, he considers as of no importance at all and pits "luck," as they call their ignorance against science. In time their enthusiasm and their spare cash wanes and grows beautifully less and they leave for their former home and loudly declare "there is nothing in the country." Before a man can prospect with any chance of success, he should take a course of training in a mine where his every day labor will teach him the lessons he must know. Theory are all very well in their place but theories have no place in the location of a silver vein. Practical work in a shaft with drill and hammer will give a man practical insight into rock formation which is absolutely necessary. This is the practical school of science that knock theories sky high. A man cannot be a successful prospector in a minute or by inspiration. He must have knowledge of rock formation and must apply that knowledge. Without this, mere wandering in the bush is like carrying water in a griddle.—Cobalt Free Press.

A FIGHT FOR A MINE.

A motion was heard by Master-in-Chambers Cartwright, on July 31, that involves the title to a silver mine said to be valued at something like $750,000, situated in the Township of Coleman, District of Nipissing, being the south-western part of lot No. 3, sixth concession.

Messrs. Arthur G. Browning, W. M. Boultbee and John Ferguson made an application that in the suit brought against them by Charles F. Hanson the writ of summons should be set aside, that $1,000 as security for costs should be furnished, and demanding that his suit proceed to trial in the non-jury sittings.

While Hanson described himself in the writ as a resident of Toronto, they stated he was a resident of the United States, and was going back there.

Hanson brought suit in May against the defendants named. He asked for a declaration that the mine is held in trust for him, in pursuance of an agreement between himself and Murdock McLeod, George Glendenning, and Arthur G. Browning. He asks for damages for breach of contract, for an injunction preventing the disposition or the working of the mine, and to prevent those named from trespassing on it, and for an order for possession of the same.

The defendants to this suit claim that Hanson agreed to buy the mine for $250,000, but that he was to put up $15,000 before a certain date in May last, which he did not do. Therefore, they said, he lost his equity in the property. They contend that his present suits tie up the mine, when they have a chance to turn it over and sell it.

Hanson's counsel claim that when the property was mortgaged that a payment of $15,000 was made by the mortgagees, to be applied as a payment by Hanson, and that nearly $30,000 more was paid. Hanson brings a suit of the same nature against five others—L. H. Timmins, John McMartin, Noah Timmins, Duncan McMartin, W. E. Dunlop, all of Cobalt, or Haileybury.

The motion was adjourned to allow of the examination of W. F. Boultbee.

B.C. LICENSES VALUELESS.

"It must be treated as a document without statutory validity."

With these words Mr. Justice Duff consigns to the waste paper basket licenses to prospect for coal and petroleum for which the Government of British Columbia has received $50,000 in hard cash from men who, even yet, probably in the majority of instances, are not aware that they have purchased with their good money the James Bay equivalent of the gold brick, says the Vancouver "World."

The judgment of Mr. Justice Duff is of a most sweeping character and completely disposes of at least this attempt to govern by order-in-council. It is summed up in the words quoted at the head of this article. The powers of the Governor-in-Council are limited, says his Lordship. The order purported to be made under the Coal Mines Act is really ultra vires. The licenses granted by virtue of that act have no statutory validity.

As already stated, the Government has taken $50,000 from innocent prospectors for these utterly useless pieces of paper, and this at least should be returned forthwith to the men who paid for them. It is money received for which absolutely no value has been given. The matter, however, does not end here, as men who have staked and worked properties in good faith now find that they have no valid title to them, and that any man who comes along with a regular license may take possession.

THE CONSOLIDATING MINING AND SMELTING CO.

The directors of the Consolidated Mining and Smelting Company, of Canada, Limited, have declared a dividend of 2½ per cent. for the quarter ending 30th June, 1906, payable on the 1st of August, to the shareholders of record on the 23rd July.

The following is a statement of the operations of the company's smelter at Trail, B.C., for the month of May, and for the five months ending 31st May, 1906:—

	May.	5 months.
Tons ore received	30,318	148,155
Tons ore smelted	25,398	134,195
Metals produced—		
Gold, ozs.	10,221	54,387
Silver, ozs.	205,563	1,007,534
Copper, lbs.	356,343	1,949,083
Lead, lbs.	2,880,000	13,716,000
Total gross value	515,231	$2,608,362

JAMES CRONIN, OF THE ST. EUGENE.

Thirteen years ago last month James Cronin, in company with Father Cocola, and an Indian named Peter, staked the St. Eugene property, says the Moyie Leader. Then the work of converting the prospect into a mine was begun. There was no railroad, no Moyie, no Cranbrook then, and every pound of grub and supplies had to be packed from Fort Steele, thirty miles away. Cronin and Pete Olson comprised the first working force. They each took turns at holding and hammering the drill, as well as doing the cooking, sharpening the steel, etc. Then payday would come and Cronin would pull a roll of bills from his pocket, and pay Olson for his month's work. There were no labor troubles in those days. Then the force was increased, and Peter Lynch, W. P. White, Wm. and James Mills, the Hamilton boys, and John Bakke were hired. White is now superintendent and Bakke is a foreman.

After thirteen years of continuous management, Mr. Cronin has tendered his resignation, which the company has reluctantly accepted. Mr. Cronin took the St. Eugene when there was nothing but the cropping of a ledge. He leaves it the second largest silver-lead mine on the American continent, and he has made for himself a reputation as a mining man that anyone might envy. Not only that, but he has accumulated a considerable fortune.

Thursday he was arranging his fishing outfit, had two of his dogs tied, and was ready to go on a trip with T. C. Drewry, to the Old Man river in Alberta, when a representative of the paper called on him.

Mr. Cronin's family is living at Spokane, and Mr. Cronin will spend most of his time there.

PERSONALS.

Hon. Wm. Templeman has been given charge of the Department of Mines at Ottawa.

Mr. J. B. Hobson, manager of the Cariboo Consolidated Mining Company, accompanied by Mrs. Hobson, are spending a few days in Vancouver.

Mr. A. G. Campbell, of the Brown Alaska Mining Company, accompanied by Mrs. Campbell, are visiting Mr. and Mrs. R. S. Byrn, 110 Vancouver street.

After thirteen years of continuous service, Mr. Cronin has tendered his resignation as manager of the St. Eugene, which resignation the company has accepted.

Mr. A. C. Cole, late geologist of the Centre Star, Rossland, B.C., recently received a presentation service of plate, when leaving. He has removed to Cobalt.

It is understood that Prof. W. C. Baker, of Queen's University, has been appointed by the Ontario Government as assistant mining inspector of the Cobalt district for the season ending October 1.

Mr. A. E. Barlow, lithologist of the Geological Survey, has resigned that position to accept a more lucrative situation with a German mining syndicate operating in Canada. Mr. Barlow is now on his way to Europe.

Mr. W. C. Thomas, superintendent of the Dominion Copper Co.'s Boundary Falls smelter, visited Franklin camp, last month, in company with George A. McLeod, and made an examination of the Maple Leaf group.

Prof. F. Hille, who has been engaged in the eastern portion of New Ontario, for the past few weeks making an inspection of iron ore deposits for the Dominion Government, has left for a trip through the western portion of the same district.

Mr. H. A. Guess, M.A., a graduate of Queen's School of Mining, who has been manager of the Silver Lakes mines at Silverton, Cal., is about to return to Cananea, Mexico, as superintendent of reduction for the Cananea Copper Company.

Mr. J. H. Rogers, traffic manager of the White Pass & Yukon Railway, left Victoria a few days ago for Dawson. Mr. Rogers has lived in the Yukon for the past six years as general agent at Dawson, and as traffic manager, with headquarters at Fairbanks, for the past two years.

Mr A. C. Cole, late engineer and assayer of the War Eagle and Centre Star mines, of Rossland, B.C., has accepted the position of expert mining engineer to the Temiskaming & Northern Ontario Railway Commission. Mr. Cole will decide the value of ores on all the mining leases controlled by the Commission, and his decision will be final.

Alfred Beit, the well known South African financier and mine owner, died on July 16, in London. He was a life governor of the De Beers Consolidated Mines, a partner in the firm of Wercher, Beit & Co., and a director of the Rand Mines, Rhodesia Railways, Bechuanaland Railway Trust, Consolidated Company, Bullfontein Mine, and British Chartered South Africa Company. His wealth has been estimated at 125 million dollars, but it is not thought he left anything approaching that sum.

Charles Addison Bragg, District Office Manager of the Westinghouse Electric and Mfg. Company, Philadelphia, Pa., died at that place on Sunday, July 29th, after an illness of over two months' duration. Mr. Bragg was one of the pioneers in the electrical business, he having been associated with the United States Electric Lighting Company as early as 1882. His connection with the Westinghouse Electric & Mfg. Company began in the year 1889, when he was made manager of the Philadelphia office, which position he filled successfully up to the time of his death. He was 56 years old.

Mr. G. H. Robinson, of the Britannia Mines, B.C., died recently in New York. He was one of the best known mining men on the Pacific Coast. He had not been in good health for several months past. Prior to going to the coast deceased was for a long time manager of the interests of Mr. August Heinze in Montana. In all the sensational fights that Mr. Heinze had in connection with his mining interests Mr. Robinson was identified. He was a mining engineer of national repute, and was admitted to have been at the head of his profession for years, and one of the best experts on copper mining. Besides being interested in Montana, he had extensive mining interests in Utah and Mexico.

E. D. Sowden, secretary-treasurer of the Northern Development Co., of Detroit, visited Port Arthur recently with a party of Americans, most of whom are interested in the company's mining claims, and properties in the Wabigoon district.

The following composed the party:—

H. S. Ayers, Detroit; O. S. Sturtevant, Adrian, C. H. Willson, New York; G. E. Newald, Fluct. M.; G. O. Wright, Adrian; M. Frole, Toledo; J. H. Doherty, G. Winters, Detroit; C. E. Haynes, W. A. Smith, W. Clement, F. O. Bray, Adrian; F. H. Clarke, R. Strolmes, W. F. Elliot, M. S. Wain, Detroit; A. Bradley, S. D. Drewry, Cincinatti, O.; A. H. Reeder, Dayton; J. R. King, Md.; E. D. Sowden, Detroit; D. W. Bliss, Toledo; H. W. King, Adrian; A. L. Johnston, R. J. Elliot, Detroit; H. R. King, Chicago.

Mr. E. W. T. Gray, who has for years been manager of the New York sales office of the Westinghouse Electric and Mfg. Company, resigned recently to take up commercial work in another field. Mr. Gray's decision to sever his connection with the Westinghouse Company was received with great regret by the management, he having been one of the pioneer employees of the company. Mr. Gray began his work with the Westinghouse Company about the year 1890. In 1898 Mr. Gray received the appointment of manager of the New York office.

Mr. W. C. Webster, who succeeds Mr. Gray as manager of the New York sales office, has a broad general knowledge of the company's commercial policy. Mr. Webster entered the employ of the company in 1898, and has always been identified with the sales department.

MINING NOTES.

The new tungsten ore deposits near Porte Alegre, South Brazil, are stated to have been acquired by manufacturers of tungsten salts in Hanover, Germany. These deposits are extensive and rich, analyses running over 70 per cent. tungstic acid. Equally interesting is the announcement that the Wolfram Lampen Company, Limited, of Augsburg, Bavaria, will utilize the Just-Hanamann patents for the manufacture of tungsten filaments for electric lamps.

NOVA SCOTIA.

Hematite has been found at Logan's Glen, by the Canadian Mining and Development Company, near Whycocomagh.

The only crushings reported to the Department of Works and Mines of Nova Scotia during the month of June were:—Lake Catcha District, J. H. Anderson mill, during May, 30 tons crushed yielded 31 ozs. 9 dwt. 0 grs. Mount Uniacke District, J. A. Crease mill, during May, 11 tons crushed yielded 29 ozs. 12 dwt. 0 grs.

During the month of June some nine hundred gold mining areas were applied for in Nova Scotia under lease and license as per summary below:—

District.	Areas.	District.	Areas.
Oldham	2	McKay Settlement	21
Vogler's Cove	6	Leipsigate	7
Whiteburn	12	Cow Bay	11
Montague	32	Miller's Lake	72
Barrasois	18	Salmon River	18
Somerset	110	Scraggy Lake	6
Fifteen Mile Brook	10	East Rawdon	145
Stormont	64	Gold River	73
Renfrew	49	New Canada	8
South Branch, Upper Stewiacke	103	Lochaber	14
East River, Sheet Harbour	12	Brookfield	44
Earltown	15	Port Hilford	20
		Ovens	13

QUEBEC.

For three or four weeks past the iron mines at Ironsides, near Hull, which have lain idle for more than 25 years, have been the scene of considerable activity. Borings with diamond drills are being made to a depth of 400 feet, with a view of testing the possibilities of the mines. Sir William Logan, at one time Dominion geologist, declared that there should be one million tons of ore in these mines.

The mineral discoveries in the northern part of Quebec Province are stimulating the activity and enterprise of the Quebec and Lake St. John Railway.

Mr. J. G. Scott, managing director of the undertaking, states that $10,000,000 has been secured under satisfactory conditions, to build the proposed extension from Roberval to Port Nottaway on the James Bay. He believes that large traffic will arise from the asbestos, gold and other mineral deposits.

This extension would mean an addition of 380 miles, which would not, of course, be undertaken at once, but if the mining development in the Lake Chibougamou county produce the results expected, some 180 miles of the line will be built in the near future.

ONTARIO.

The Rosa Blanda gold mine on the Atikokan river has been sold to Americans.

Mr. W. A. Cockburn, of Sturgeon Falls, has made a discovery of rich iron ore in the township of Kirkpatrick, two miles from the Canadian Pacific railway south of Verner station, and about twelve miles from Sturgeon Falls.

An important mining deal was closed by the sale of the White Lily mine, in the Atikokan gold range, which Col. Baltimore bought from Messrs. Manion & Murphy 200 acres for $30,000. A $10,000 plant will be put in at once.

COBALT.

Machinery is now in course of erection at the Edison mine, near Trout Lake.

The Star Mining Co. (known locally as the Nova Scotia), shipped a considerable quantity of smaltite-silver ore during July.

The Silver Queen, which is shipping a carload of ore has nearly completed its plant, the boiler and engine having been installed.

The Nova Scotia, which has been adding to its conveniences in sections, is completing its plant and may be said to be fully equipped.

Very large quantities of ore are stored at the various working mines, awaiting the time when the Canadian smelters are ready to receive it.

The Silver King mining claim immediately east of the Nova Scotia property, is being actively developed. At present there is a force of twelve men at work.

It is reported that negotiations for the purchase of the Violet mine are in progress at $175,000, and it is hoped that active mining operations will be in progress very shortly.

Discoveries of smaltite in a gangue of calcite have been exposed in lots 2 and 3 Con. X, Lorrain township, and opening up and further prospecting are in active progress.

Native silver has been discovered on the Quebec side of Lake Temiskaming, in Fabre, Pontiac Co., but so far insufficient development has been done to demonstrate actual values.

Prof. W. E. Hidden, F.G.S., states that he has discovered the presence of polybasite in veins in the Cobalt district, thus adding another rare mineral to the thirty odd known to exist in this camp.

Development on the Beaver Mining Company's property in Con. 3 of Coleman is showing up a high grade body of native silver bearing ore. This property is controlled by Montreal gentlemen.

A four-inch vein of smaltite has been uncovered in Bucke township, immediately at the head of Sharp Lake. The claim is owned by the Silver Ledge Mining Company, and development is in progress.

The T. & N. O. Railroad Commission have leased the mining rights of the right-of-way to a syndicate of Ottawa men. It is stated that a bonus of $50,000 was paid, and all ore mined will be subject to royalty.

The De Forrest wireless telegraphic station at Haileybury is nearing completion, and New Ontario will be brought nearer civilization than even the most sanguine enthusiast could have imagined a year or so ago.

It is reported that the McLeod & Glendenning property has been purchased by a syndicate composed of the owners of the La Rose mine—Messrs. McMartin, Dunlop & Tinmins — Messrs. John Ferguson, Boultbee and others.

The work of partially draining Peterson and Cart Lakes is rapidly proceeding. A new ledge was discovered on the shore of the former at the end of July, which is stated to be one of the richest in native silver, in the district.

Dr. Drummond and family are spending the summer at their new residence at the Drummond mines on Kerr Lake. Diamond-drilling and development work are in successful operation, and further shipments of ore were made during July.

The McKinley-Darragh-Savage has installed a boiler, engine and compressor plant, which some people expect to see in operation within a week; but as this company conducts its operations with great secrecy it is difficult to predict when the plant will be in operation.

Prospecting parties returning to Haileybury and locality, from the Quebec side of Lake Temiskaming, state that they have located quartz veins, which pan gold in fair quantity every sample. As to whether there are any deposits of economic value still remains to be proven.

It has been rumored for some time that the Canadian Pacific Railway has its eyes upon the Timiskaming district and it is generally believed that the recent application for a charter to build a railway from Fort Timiskaming to Haileybury, was advanced in the interests of that corporation.

The King Cobalt Mining Corporation property on the west side of Cross Lake is being energetically prospected. A tunnel has been driven 146 feet into the hill, and is still being continued. One vein was struck about eight inches wide, and this is now being drifted upon. Values up to the present do not run high.

The Montreal-Cobalt Mining Company is operating on a 107-acre tract on the south side of the Montreal river and immediately next to the noted Gillies' limit, which the Government has withdrawn from location with a view of mining the area on its own account, if it does not conclude to lease the territory.

A compressor plant has been installed at the Silver Leaf, and the property is to be further prospected underground by cross-cut from the main shaft, in the most expeditious manner. Superintendent Clark is pushing the work ahead as rapidly as possible, and states he will be able to ship within six weeks.

Mr. A. C. Cole, late engineer and assayer to the War Eagle and Centre Star mines, Rossland, B.C., has been appointed expert mining engineer to the Temiskaming & Northern Railroad Commission. The duty of sampling and valuing for royalty purposes all ore mined on the Commission's leased properties will fall to his lot.

Government Commissioner Price sat during July at Haileybury hearing the various mining disputes, arising out of "discovery or no discovery," and in regard to other matters. The amount of litigation in progress is much to be deplored, and is undoubtedly proving a serious drawback to New Ontario's mining development.

Development at the working mines is steadily increasing and several properties report new discoveries, both on the surface and underground. Near Ledge No. 26 on the Nipissing Company's property a new vein has been uncovered, showing high values in silver. This is the second find within a few feet, during the last fortnight.

Considerable anxiety is being caused in the town and district by the appearance of typhoid fever. The long expected supply of pure water from Clear Lake has not put in an appearance, and the supply of spring water has dwindled to a mere trifle. The springs have run dry in many cases, and in others the water supply is full of disease germs.

The new hydraulic plant on the Nipissing property has already justified itself. One large smaltite ore body has been exposed near the shore of Peterson Lake, as also has a small vein, running high in native silver. New boarding and dining camps, which will accommodate up to 300 men have just been completed, and the development of this company's property is fully in proportion to its acreage.

The Temiskaming & N. O. Ry. engineers are surveying for a spur line from Cobalt to Kerr Lake. This will run round the south end of Cobalt Lake through the McKinley & Darragh, & Nipissing Coy.'s properties. It is hoped to have the line completed during the coming winter. Speaking generally, the railroad engineers are much to be congratulated on the condition of the road-bed on the main line. It is in excellent shape.

A new strike of valuable ore was made recently on the east shore of Lake Sassaganaga, on ground just west of the Trethewey mine, and operated by the Amalgamated Mines Company. The territory has not been regarded as surely productive heretofore. The vein is about two inches wide on the surface; but as the outcrop has not been blasted or trenched it is difficult to forecast the length or value of the discovery.

Forest fires are raging throughout the Temiskaming region from Temagami to Englehart. The country is dry as tinder. A protracted drought has prevailed and thousands of prospectors are in the woods, many of whom are careless. Further north settlers are making clearings and they, too, are frequently indifferent to fire possibilities.

Down at Gillies Depot the men have been fighting to save the buildings. For several days, in fact for weeks, bush fires have been raging up the Montreal River.

Work is progressing rapidly at the Jacobs mine at Kerr Lake, now that all the new machinery is in place. In reference to the new discovery made last month two items are of particular interest. The vein cuts the Huronian and diabase contact almost at right angles, and is well defined and high grade in both formations. Dyscrasite or antimonial silver is present in massive form, at one point being 11 (eleven) inches in width of practically pure mineral. This adds another to the list of comparatively rare minerals discovered in the Cobalt camp, and is all the more interesting on account of the massive form in which it occurs.

Gasolene launches are now carrying prospectors and tourists for 35 miles up the Montreal River from Latchford, with one change of boats at the first rapids. Latchford is becoming quite a little town, under the influence of the mining development. So far no silver in quantity has been discovered up the Montreal River. Cobalt Bloom is plentiful, but veins are not to be found in any number. One about two inches wide near Iron Lake, a mile N.E. of Portage Bay, is rich in native bismuth, and another, near Front Lake, on the borders of Timagami forest reserve, shows about two feet of calcite heavily shot through with smaltite, this latter is perhaps the best in the particular locality.

During the last month the reported discovery of gold, both in quartz and as placer, near Lake Opasatika on the Quebec side, attracted great interest throughout New Ontario, and several parties left Cobalt, Haileybury and New Liskeard, for the "New Eldorado." Undoubtedly many handsome specimens of visible gold in quartz influenced the more speculative individual—but on the return of the various parties without even a "color," the anticipated rush has been checked.

Gold undoubtedly is present in the various sand bars, and quartz veins are plentiful—most of which pan gold—but not in paying quantities, and the discovery of a "New Klondyke," as it was locally called, is still a question of future prospecting effort.

The latest discovery at the Foster mine is not only interesting from a geological standpoint, but should (among others) prove an object lesson to those who are in favor of "discovery" as opposed to continuous "working conditions." From the forty-five foot level in one of the shafts a cross-cut for underground prospecting purposes, disclosed a vein upwards of eight inches in width, carrying high values in native silver. No indications of the same can be found on the surface—which had been stripped some time previously—as to either vein or value! Comment is unnecessary. Upon another vein on the Foster property, high values in native silver are found in the country rock, outside the vein proper for a distance of two feet; in point of fact the mineral is perhaps more plentiful outside the gangue than in it. There is a large quantity of ore of the highest grade in silver bagged up, awaiting the decision of the directors to ship.

Six miners have been arrested for stealing ore from the mines and disposing of it to jewellers and souvenir vendors, who make it up into pins and other articles. It is thought the thieving has been going on for months and that the mine owners have been robbed of thousands of dollars' worth of silver. The Mine Owners' Association have been aware of the operations of some of their employees, and applied to the Noble Dominion Detective Agency of Toronto to send a man to establish a system of espionage. The detective went down into the La Rose mine, where much of the ore is pure silver, and chummed it with some of the men, who informed him he could make hundreds of dollars a month out of the business of selling nuggets to the jewellers. He was also informed that there was a man in Toronto to whom he could dispose of the stuff.

Acting on the information gathered by the detective, the mine owners decided to search the bungalows of the suspected men. In some cases trunks full of valuable ore were discovered. The officers also located some of it hidden in the woods.

Advantageous bargains for the lease of mineral-bearing lands were closed by the Temiskaming & Northern Ontario Railway Commissioners at a meeting held on July 18. Eight Ottawa gentlemen, who had not yet formed a company, secured the right to develop the portion of the railway right-of-way other than the track allowance, between mileage 101 and 105. This extends two miles to the north and south of Cobalt. The northwest 40 acres of the Cobalt town site has also been disposed of on somewhat similar terms to those exacted for the southwest 37 acres a little while ago.

The parties who have acquired the right-of-way will pay to the Government Railway a bonus of $50,000, while the purchasers of the northwest 40 acres will contribute a bonus of $22,000. All will pay royalties while the 999-year lease is in force. These will be figured out at 10 per cent. of the gross value at the mouth of the mine of all ore mined assaying less than $400 a ton; 25 per cent. when the value is between $400 and $1,000 a ton, and 50 per cent. when the output assays over $1,000 a ton.

Prof. Miller is still pursuing his topographical and prospecting work in the Gillies timber limit. At the writer's last interview with him the Prof. stated that the veins so far discovered were small (with exception of one six in. in width of solid smaltite, near Cart Lake), and carrying but little silver, and the prospecting part of the enterprise does not at all seem to be equal to expectations.

It is generally conceded locally that the Ontario government will not carry out their original intention of mining the Gillies limit for the benefit of the ratepayers of the province generally.

A good suggestion—meeting with general favor in the district—was put forward at one of the recent meetings of miners and prospectors in regard to the method of dealing with the mining rights of this much discussed limit, viz.: That when the same are disposed of by the government no bonus should be asked, and that tenders should be upon the basis of royalty only, thus giving the poorer prospector or miner a more equal chance of acquiring a portion of it.

A showing of smaltite and native silver has been exposed on the G. W. Lawson claim lying N.E. of the Drummond mines. This property must not be confounded with the "Lawson" mine which has been and still is the subject of so much regrettable litigation.

ALBERTA.

The Canadian Pacific is making a test to ascertain whether or not there is oil underlying the natural gas field at Medicine Hat.

Nine carloads of drilling machinery arrived at Medicine Hat, consisting of a cable drilling outfit, and drill pipes of various diameters. The drill is a modern one and is capable of fast work, and will be the first cable-rig to work in this field. The greatest depth that has been reached in this field is 1,010 feet, where there is a tremendous flow of natural gas, and if necessary 2,500 feet deeper will be sunk. This test should certainly ascertain what is below and the result of the test, if oil is found, will mean as much to Medicine Hat as the great gas find of a few years ago.

The work will be in charge of Mr. Eugene Coste, while the drilling will be in charge of Mr. Gunter, who has been doing the gas drilling at Edmonton. It will be necessary to start drilling a fourteen-inch hole, and work down smaller from that diameter. The well will be drilled on Bull's Head Creek, about three miles from Medicine Hat.

BRITISH COLUMBIA.

Mr. A. J. McMillan, managing director of the Le Roi Mining Company, has arrived in Rossland from London.

The Pine Creek Power Company, Ltd., Atlin, put off a very successful shot in their No. 1 pit. Some 1,500 pounds of powder were used.

It is said the Granby Consolidated Mining & Smelting Co., of Grand Forks, have closed a contract with the C.N.P. Co., of Fernie, for a full supply of coke to fill their requirements for the next three years.

The Whitewater mill in the Boundary district is running full blast again after having been shut down for many years. S. S. Fowler and associates are operating the Whitewater and the Whitewater Deep under a lease.

Mr. E. M. Hand, of the Ymir, has been in Nelson, engaging miners. Work has been begun on a 2,500 foot flume that will be completed within the next 30 days. Not being able to obtain sacks for shipping the ore, Mr. Hand is having the output placed direct on the cars. About 90 tons daily is being treated at the mill.

The Vancouver Syndicate, who own the Imperial Limited group on Gold Gulch, Gainer Creek, Lardeau, will work the property all summer. The stripping has uncovered a fine lead six feet in width, carrying galena and carbonates of a shipping value. The work to be done this summer will consist of driving a crosscut tunnel for about 125 feet.

Important changes in the management of the Canadian Metal Company, have taken place.

Mr. S. S. Fowler, M.E., of Nelson, has been appointed resident manager.

Mr. F. W. Rolt retires from the position of secretary and is succeeded by Mr. J. E. Harrington.

Managing Director Riondel and Secretary Harrington will leave for Paris shortly, and in their absence Mr. Fowler will have full charge of the company's operations.

A $10,000 clean-up by the Société Minière de la Colombi Britannique on Boulder Creek, Atlin, B.C., augurs well for the present season's operations being the most successful in the history of that company. During previous seasons the company confined their energies to the handling of the gravel in the bed of the creek with only moderate returns. This year, however, under the direction of T. Obalski, M.E., the operations have been carried into the southwest bench of the creek where, with the re-arrangement of both flume and piping plant, a large yardage of gravel has been removed with most satisfactory results. The above amount was secured from the three upper boxes of the sluice and is taken as conclusive proof that the company is opening up rich ground.

The task of deepening the shaft of the Le Roi from the 1,350 foot level has been begun. The winze has now reached a depth of 1,700 feet, being about 50 feet below the 1,650 foot level, and between the 1,350 foot level and the 1,700 foot level some large shoots of ore of a pay grade have been encountered. That these shoots are of sufficient importance to justify the extension of the shaft is shown by the orders received from Managing Director McMillan. The shaft is a five-compartment one, and from the 1,350 foot level it will cost from $130 to $150 a foot to deepen it, so it will be seen that the deepening of the shaft will cost a considerable sum. The average output of the Le Roi is 2,820 tons per week. Some high grade ore is being taken from the Peyton ledge.

Although the discovery was made three weeks ago, the almost fabulous wealth of the Gold Hill region was not known until recently. An ore body three feet wide and of unknown depth and length has been located to Telluride, which assays from $265 to $8,000 per ton in gold and silver. Two hundred miners are already in the new field, where Col. J. H. Conrad, of Windy Arm fame, who already has large interests at Gold Hill Mountain, is building eight stone houses for camps.

Governor McInnes and Comptroller Lithgow arrived from Dawson last night and left for the new quartz field this morning. Gold Hill is located twenty-two miles from the White Pass Railroad, which is left at Robinson, twenty miles south of White Horse. The new strike is attracting more attention than any ever made in the North.

A discovery of an important copper-gold deposit, which with development may rival the famous Britannia property, has been made by Joseph Saulter, a prospector well known in Kootenay and Similkameen. The find is situated some three or four miles to the northeast of the Britannia.

In Rossland, persistent rumors are current that the Great Northern people are doing their utmost to bring about another mine merger which would result in that railway again obtaining an ore tonnage from that camp and enable the Northport smelter to blow in. It is stated that efforts are being made to bring about a consolidation of the group of properties on Red Mountain lying to the west of the Le Roi No. 2, including such well known properties as the Giant, Gertrude, California, Coxey, and others, all of which have been more or less extensively developed in past years, but which are lying idle to-day.

For the first six months of 1906, the output of the mines of the Boundary show a total of 633,526 tons, with an estimated total valuation of more than $3,000,000. During the same period of 1905, the mines of this section, practically the same properties, shipped 458,193 tons of ore, valued conservatively at a little over $2,000,000. In the absence of definite valuations of the products from all the mine managers, the average per ton is placed at $5. These figures show that the output of 1906 thus far, as compared with that of 1905 for the same period, is an increase of nearly 50 per cent. The ore record for June is slightly larger than for May, notwithstanding the fact that the British Columbia Copper Co.'s smelter is out of commission, owing to extensive enlargement in progress at the reduction works. Granby shipped nearly 12,000 tons more in June than in May, and Dominion Copper sent out about 2,000 tons more than the previous month.

A contract for the construction of twenty miles of ditches to bring water to the Cariboo Gold Mining Company has been awarded to Messrs. Macdonell & Gzowski, of Vancouver. The members of this firm are J. A. Macdonell, a partner of C. E. Loss in the building of the C.P.R. line from Spence's Bridge to Nicola, and C. S. Gzowski, who has been assistant to Mr. Macdonell.

The Cariboo Gold Mining Company is the style of corporation under which the Guggenheims are operating in the Cariboo. They bought the properties of the Cariboo Consolidated Hydraulic some months ago, the sale being negotiated through J. B. Hobson. Mr. Hobson is retained as general manager of the properties.

For many years the operation of these properties had been hampered through lack of water in the summer. In order to get the necessary water it is the intention of the Guggenheims to build some sixty or seventy miles of ditches and flumes. The contract let to Messrs. Macdonell and Gzowski is the start toward providing more water. The ditch to be built by them will have a capacity of five thousand miners' inches of water. It is to be completed by fall.

YUKON.

Owing to the need of the waters of the Yukon lakes and streams for mining the Government has adopted stringent regulations for the use of the water for power purposes. The ordinance passed by the Government authorizes the Minister of the Interior to grant a lease of water to develop power for a period of not more than twenty years, upon proof of the ability of the applicants to utilize the power expeditiously and of volume of unrecorded water available on the report of the Government mining engineer, he may grant such water as he thinks may be reasonably required by the applicants for the purpose specified. Waste or failure to utilize power may be punished by cancellation or reduction. Grants are subject to rights of miners who at the time of granting may be working on the stream above or below. Location of the ditch must be approved by the Yukon Commissioner, who shall have power to permit change of location upon proper notice. When power is sold distribution and price are under control of the Yukon Commissioner. The fees to be paid the Government for water, $10 for fifty miners' inches or less; fifty to two hundred miners' inches, $25; two hundred to a thousand inches, $50. Every additional thousand or fraction thereof, $50. The amount to be expended on development work for the first year, and the times at which the power plant is to be in working order have to be specified.

COAL NOTES.

Shipments from the Cumberland Railway and Coal Company's collieries for the month of July were 27,706 tons.

The Dominion Coal Company has recently completed an iron and brass foundry in connection with its shops at Glace Bay. It is of the most modern construction with steel frame and brick walls. Thirty men are employed.

For the year ending June 30th, the output of the different collieries of the Nova Scotia Steel and Coal Co. exceeded all previous records.

In 1904-5, the total production amounted to 476,510, as against 558,316 tons in 1905-6. This is over 80,000 tons in excess of last year, and with the installation of modern machinery and the opening up of the old Queen pit, there is no reason to doubt that the ensuing year will mark an epoch in mining for this industry.

There are at work in the mines over 2800 men, exclusive of the office staff.

There are rumors of many extensive additions and alterations in the near future, particularly with regard to the company's railway. This company is now about to commence the development of large limestone areas in Richmond county which they have under lease. The areas are located less than a mile from an excellent shipping point on the Bras d'Or Lakes.

The new tipple now just finished by contractors, Frayer & Sinclair, for the Canadian-American Coal Co., is one of the largest and best constructed in Western Canada. It resembles somewhat that of Michel, although providing many improvements over the latter. This building which contains over 320,000 feet of material, is 60x120 feet in length, with an incline by another system of haulage. The tipple which will be fully provided with the latest machinery for the expeditious handling of coal has a storage capacity of 1,000 tons and capable of handling 2,700 tons in a ten-hour shift. There is now being installed picking tables, screens, dumps, automatic car haulage, and automatic car-loader, and this tipple will be fully up-to-date when all of the machinery now on the ground has been placed in position. The mine itself is in excellent shape to produce a large tonnage of coal and the shipments from Frank will be second to none in this district just as soon as the new tipple is put into commission.

THE MINING AND INDUSTRIAL SHARE MARKET.

(Specially reported f r the CANADIAN MINING REVIEW by ROBERT MEREDITH & Co., Mining Brokers, 57 St. François Xavier St., Montreal.)

The markets during the month have been more or less of a holiday character, prices in the main are firm, but business is very limited. Amongst the mining stocks International Coal has been the feature and has scored an advance of some fifteen points. This stock, which was largely marketed in the West at lower prices, has now come back, the present demand being now almost entirely local. It is reported that the company's prospects are exceedingly bright, and that a dividend is nearly in sight.

Industrial stocks are almost unchanged. There has been a little buying of the Dominion Iron & Steel issues on the company's improved position, and Nova Scotia Steel has advanced on very limited transactions in sympathy with other stocks of steel and iron industries.

One reason for the small amount of speculation is the stringency of the money market; the amount of funds available being very limited.

The latest quotations are as follows:—

	Bid.	Asked.
Consolidated Mines	128	132
Can. Gold Fields	6½	7¼
Granby Consolidated	12	12¼
Rambler Cariboo	22	24
North Star	5	...
Monte Cristo	2	3
White Bear	8	9
California	2	3
Virginia	5	7
Deer Trail	...	1½
International Coal	65	67
Sullivan	2½	3½
Jumbo	22½	25
Cariboo-McKinney	1½	2½
Denoro	7	8
Diamond Vale Coal	15	20
Dominion Copper	2⅛	2¼
Dominion Coal (common)	76	78
Dominion Coal (pref.)	115	115½
Dominion Iron & Steel (com.)	28¾	29
Dominion Iron & Steel (pref.)	78	80
Intercolonial Coal (com.)	85	86
Intercolonial Coal (pref.)	...	...
Nova Scotia Steel & Coal	71	71½
Nova Scotia Steel & Coal (pref.)	122	125

COMPANY NOTES.

Allis-Chalmers.

At the last special meeting of the stockholders of the Allis-Chalmers Company held in Jersey City, it was voted to authorize an issue of bonds to the amount of $15,000,000, of which $12,000,000 are to be offered at 80 per cent. for subscription by the preferred and common stockholders of the company, the remaining $3,000,000 to be reserved for the present in the treasury of the company.

The stockholders also approved a conditional contract between the company and Shearson, Hammil & Co., acting in behalf of a syndicate which includes and may include several directors of the company, for the acquisition by the syndicate of such bonds as may not be subscribed for by the company's stockholders.

AN ELECTRIC DUMP CAR.

The accompanying cuts illustrate The Jeffrey Manufacturing Company's new design for electric slack dump car, which covers a wide range of usefulness, and which may be adapted to meet a number of different requirements.

The car consists of a structural steel truck or frame, upon which is mounted a steel hopper. The truck is provided with such electrical equipment as the required duty demands.

In the car here illustrated, the equipment consists of two Jeffrey H.H. 64, 250 volt motors, one motor being geared through a single reduction to each axle, the gears being enclosed in dust proof cases and running in oil.

The journal boxes are removable without dropping the wheels, and are provided with renewable steel wearing faces. The boxes are held in cast steel pedestals which are securely bolted to the steel channel frame, and which are also braced at the lower end with diagonal braces.

Four sand boxes of liberal capacity are provided.

The brake is of the well known Jeffrey Self-Locking type.

The hopper is built of heavy sheet steel suitably braced and re-enforced, and when loaded as shown in the accompanying illustrations, has a capacity of 25,000 lbs. of run of mine coal. This hopper is so supported on the frame that the weight is uniformly distributed throughout the structure.

Probably the most novel feature of this car is the ease and rapidity with which the load may be discharged.

To facilitate this, the bottom of the car slopes from a hip or ridge in the centre down to the bottom edge of each side door, and at the front end is a triangular face or slope descending from the ridge to the bottom edge ot the front door. The angle of slope of the bottom is made

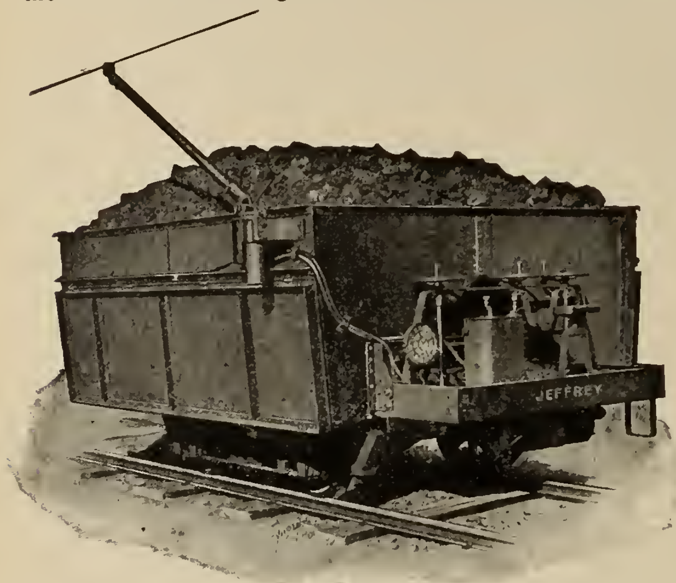


Fig. 1.

whatever may be necessary to readily discharge the material to be hauled. The doors are securely hinged to the body of the hopper, and are so hung that they open slightly by their own weight whenever the holding chains are loosened. This feature, together with the sloping bottoms result in a free and rapid discharge of the load.

Each door is provided with three chains for holding it closed. The two side doors are operated simultaneously, the front door being operated independently. The chains are wound upon windlass shafts and each chain is pro-

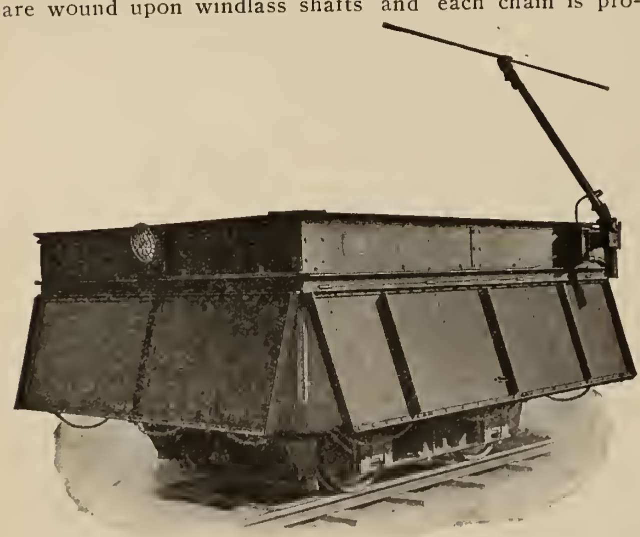


Fig. 2.

vided with length adjustment so that the strain may be equally distributed on all of the chains. The method of operating these doors may be arranged to suit the purpose for which the car is to be used. For instance, each door may be operated separately, any two may be operated together, or all doors may be arranged to operate simultaneously.

The mechanism for operating the doors is self locking in any position, and is easily and quickly manipulated. Figure 1 shows the convenient arrangement of the operating mechanism. The vertical shafts and hand wheels at the right and left operate the front and side doors respectively, and the hand wheel and shaft in the centre operate the brake. At the left of the operator's seat is seen the controller, and at the right, supported between the brake and the front door control shafts are seen the sand valve handles.

Each car is provided with two headlights, and a gong is located under the floor plate within reach of the operator's foot. The car illustrated is used for handling slack, and discharges its loads from a trestle elevated at a considerable height above the ground. Dumping the slack from the front and both sides will gradually form a fill or embankment upon which extensions to the track may be laid.

These cars are built in several sizes and for any purpose to which they are suited, by the Jeffrey Manufacturing Company, Columbus, Ohio, U.S.A.

INDUSTRIAL NOTES.

The Denver office of the Allis-Chalmers Company has been removed to the McPhee Building, 17th and Glenarm streets, and the El Paso office to the Guarantee Trust Building, Rooms 301-305.

The Canadian Rubber Co. of Montreal, Ltd., have just concluded a deal whereby they obtain exclusive control of rubber advertising in all street cars owned and operated in the principal cities and towns in Canada.

The corporation of Fredericton, N.B., has awarded to Allis-Chalmers-Bullock, Limited, Montreal, the contract for the municipal pumping engine. It will consist of "Allis" high duty, horizontal, double acting, crank and flywheel pump, driven by a cross-compound "Reynolds"-Corliss engine. The pump will have a capacity of 1,500,000 gallons for ordinary service and of 4,000,000 for fire service. Both pump and engine will be built at the works of Allis-Chalmers-Bullock, Limited, in Montreal.

Among the orders for Farrel Bacon Crushers built by the Jenckes Machine Co., Limited, of Sherbrooke, was one for a 10 x 16 crusher shipped R. C. Mosher, Plaster Rock, New Brunswick, and one of 24 x 13 size shipped Coast Quarries, Limited, Vancouver, B.C. The former was sold through W. H. C. Mussen & Co., Montreal, and the latter through the Vancouver offices of the Jenckes Machine Co., Limited. The Canadian Pacific Railway made a record run on the Vancouver shipment taking the car from Sherbrooke to Vancouver in fifteen days.

The 250 horse power electric hoist which was built for the Granby Smelter at Phoenix, B.C., by the Jenckes Machine Co., Limited, of Sherbrooke, Que., has recently been shipped. The fact that this hoist has been built by a Canadian firm is noteworthy, as heretofore electric hoists of large size have been regularly imported from the United States. The hoist has two conical drums, each 8½ feet in diameter at large end, 5 feet diameter at small end and 5½ feet long, both drums being capable of independent operation through the medium of powerful friction clutches. The capacity of the hoist is a load of 10,000 lbs. on drum at 500 feet per minute, and the shipping weight in the vicinity of 50,000 lbs.

For some months past, the officers and engineers of the Montreal Street Railway Company have been in consultation over the question of improvements. After careful consideration it was decided that the increase in traffic justified the purchase of a 1,000 K.W. Westinghouse Railway Generator, as well as three 500 K.W. Westinghouse Motor Generator Sets. For the new cars, which promise to be the easiest and most comfortable of any in Canada, twenty quadruple equipments of motors were ordered, and fifty sets of Westinghouse Air Brakes with motor driven compressors.

The fact of the Montreal Street Railway adopting the Westinghouse apparatus and intrusting the making of this costly equipment to the Canadian Westinghouse Company is clear evidence that Canada is now able to compete with the world in everything electrical.

The West Kootenay Power and Light Company, which supplies electricity to many of the mines, reports unusual activity in this direction, so much so that they have decided to extend their electrical distribution plant.

On the advice of the well-known consulting engineers, Messrs. Ross & Holgate, whose opinions on matters electrical, are born of wide experience, the West Kootenay Power and Light Company are adding to their already splendid equipment six Westinghouse raising transformers of 1,875 k.w., 2,200 to 60,000 volts, and fifteen lowering transformers of 1,250 k.w., 60,000 volts to 2,200 and 440 volts.

Throughout the entire West there is a marked increase in the use of electricity, including the employment of electric locomotives in place of steam for mine haulage, fast traction work, factory yards, etc.

MINING INCORPORATIONS.

NEW BRUNSWICK.

Rothwell Coal Company, Ltd.; capital, $500,000, in 500 shares of $100 each. Head offic, Dorchester, N.B. Provisional directors: George Frederick Atkinson, of Rexton, N.B., merchant; John Nute, of Portland, Me.; master mechanic; Charles Smith Hickman, of Dorchester, N.B., gentleman; Albert J. Chapman, of Dorchester, N.B., barrister-at-law; Charles Lionel Hanington, of Dorchester, N.B., barrister-at-law.

ONTARIO.

The Hudson Cobalt Mining Company. Capital, $300,000. Head office, Barrie, Ont.

The Amalgamated Cobalt Mines, Toronto; capital, $100,000; provisional directors, George McP. Clark, barrister; T. C. Russell, solicitors' clerk; Ethel Mabel Lindsay, accountant.

The Wabi Cobalt Silver Mining Co. Capital, $500,000. Head office, Cobalt. Provisional directors: John Rupert Gamble, Thomas Langton, jr., George Kiely, William A. Marsh and John Martin.

Amalgamated Cobalt Mines. Head office: Toronto. Capital, $1,000,000. Shares, $1.00 each. Provisional directors to be George McPhail Clark, Thomas Clarkson Russell and Ethel Mabel Lindsay.

The Cobalt Diamond Drilling and Development Companp, Ltd., with head office at Toronto, capitalized at $50,000. Provisional directors: Stewart Jenkins, Douglas Penton, and George J. Ashworth, all of Toronto.

The Amalgamated Cobalt Mines, Ltd. Capital, $100,000,000. Head office, Toronto. Provisional directors: George McPhail Clark, Thomas Clarkson Russell, and Ethel Mabel Lindsay, all of Toronto.

Cobalt Diamond Drilling and Development Company, Limited. Capital, $50,000. Shares, $100 each. Head office: Toronto, Ont. Provisional directors to be Stuart Jenkins, Douglas Ponton and George Johnston Ashworth.

The Wabi Cobalt Silver Mining Company, Limited. Capital, $500,000. Shares, $1.00 each. Head office: Cobalt, Ont. Provisional directors to be John Rupert Gamble, Thomas Langton, jr., George Keilty, William Alexander Marsh and John Martin.

Giant Silver Nugget Mines, Limited. Capital, $1,000,000. Shares, $1.00 each. Head office: Haileybury. Provisional directors of the Company to be John David Spence, John Campbell MacMurchy, George Abram Walker, Eliza Spearing and John Shirley Dennison.

The Hudson Cobalt Mining Co., Limited. Capital, $300,000. Shares, $1.00 each. Head office: Barrie, Ont. Provisional directors of the company to be John Knox Lindsay, Alfred William Wilkinson, Alexander Touchette, Frank Lindsay Burton, Noah Grose, Harry Duncan Jamieson, Charles Devlin, William Graham Colville and William Alvis Boys.

BRITISH COLUMBIA.

British Columbia Mining Exchange, Limited. Capital, $25,000. Shares, $100 each.

The Colonial Trading Company, Ltd. Capital, $25,000, divided into 25,000 shares of $1 each.

The British Columbia Mining Exchange, Ltd. Capital, $25,000, divided into 250 shares of $100 each.

The Greenwood-Eureka Mining Company, Ltd. Capital, $300,000, divided into 300,000 shares of $1 each.

The Greenwood Eureka Mining Company, Limited, non-personal liability. Capital, $300,000. Shares, $1.00 each.

The Stemwinder Gold and Coal Mining Company. Capital, $1,250,000. Shares, 1,000,000 preference; 4,000,000 ordinary shares; all at 25c each.

The Stemwinder Gold and Coal Mining Company, Ltd. Capital, $1,250,000, divided into 1,000,000 preference and 4,000,000 ordinary shares, all of 25 cents each.

CATALOGUES.

The Wellman-Seaver-Morgan Company of Cleveland, Ohio, has issued a pamphlet descriptive of "Water Power Equipment for Low Heads." It contains some useful tables in addition to the descriptive matter.

The high grade, geared, hoisting engines, manufactured by the Wellman-Seaver-Morgan Company, Cleveland, Ohio, U.S.A., are figured and described in a pamphlet just issued. Those needing high grade hoists should procure a copy of this pamphlet.

We are in receipt of the following circulars issued by the Canadian Westinghouse Co., Ltd., Hamilton, Ont.:

No. 1035—The Westinghouse No. 12a Railway Motor.
No. 1132—The Westinghouse Protective Apparatus.
No. 1133—Westinghouse Revolving Field Alternators.

The Coal Pick Machines, manufactured by Sullivan Machinery Co., Railway Exchange, Chicago, U.S.A., are adequately described in "Modern Methods of Producing Coal." This superbly illustrated pamphlet will be sent on demand to all who write and mention the "Canadian Mining Review."

The Carter Auto-Magnetic Ore Separator Company, 123 Liberty street, New York, is sending out an illustrated pamphlet descriptive of their "Ore Separator and Concentrator," which is operated without artificial power, requires no dynamo, engine, or electric current, and has no gearing or other moving parts.

The B. F. Sturtevant Company, Hyde Park, Mass., have issued Bulletin 132, descriptive of the Economizers used in the power houses of the Interborough Rapid Transit Company, and other railway and municipal corporations. It describes the magnificent power plant of the Interborough Rapid Transit Company with considerable detail.

For years the balances made by Henry Troemner, of Philadelphia, Pa., U.S.A., have been considered standard —there is none better. The latest illustrated catalogue issued by this firm describes all the balances made as a result of years' experience, and covers everything from a dispensing scale to an assay balance, with a sensibility of 1-200 milligram.

The following catalogues have reached us from the Wellman-Seaver-Morgan Company, Cleveland, Ohio:—

M—101—Akron Crushing Rolls.
M—202—Copper Blast Furnaces.
M—103—Stamp Mills and Equipment.
M—104—Copper Converters and Equipment.
H O—9—First Motion Winding Engines.

Messrs. Fraser & Chalmers, Ltd., London, England, have issued a "General or Index Catalogue," which is intended for the information of their numerous customers, being a brief description (mostly by means of illustrations), of the machinery manufactured and supplied by them. Few more useful catalogues could be consulted by a mining engineer. The illustrations are unusually good.

The Westinghouse Co., Ltd., Hamilton, Ont., sell a great deal of machinery to Spanish-speaking countries, and the demand for technical literature dealing with these machines in that language is considerable. To meet this demand the Westinghouse Co. has issued a work entitled, "Industrias y Productos de Westinghouse," descriptive of the various productions that have made the firm world famous.

Wherever the English language is spoken Fairbanks scales are known, and it is a sign of the energy with which the business is conducted that the firm has seen fit to issue a publication descriptive of its various products. No. 6 of Volume 1, is a "Toronto Number." It is intended to acquaint the thousands of customers in and around that city with the facilities that now exist for supplying their requirements.

The Canadian Westinghouse Company, Ltd., of Hamilton, Ont., has issued a very interesting description of the electric locomotives manufactured by the Westinghouse Company, and in use by the N.Y., N.H. & H. Railroad and other lines. Descriptions are also given of the Swedish State electric railways, and it may be remarked that the conditions in Sweden are approximately the same as those governing Canada.

DOMINION OF CANADA

SYNOPSIS OF CANADIAN NORTH-WEST MINING REGULATIONS.

COAL—Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of 10 cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ—A free miner's certificate is granted upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner having discovered mineral in place, may locate a claim 1,500 feet x 1,500 feet.

The fee for recording a claim is $5.

At least $100 must be expended on the claim each year, or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey, made, and upon complying with other requirements, purchase the land at $1 an acre.

The patent provides for the payment of a royalty of 2½ per cent. on the sales.

Placer mining claims generally are 100 feet square ; entry fee $5, renewable yearly.

A free miner may obtain two leases to dredge for gold of five miles each for a term of twenty years, renewable at the discretion of the Minister of the Interior.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles. Rental $10 per annum for each mile of river leased. Royalty at the rate of 2½ per cent. collected on the output after it exceeds $10,000.

W. W. CORY,

Deputy of the Minister of the Interior.

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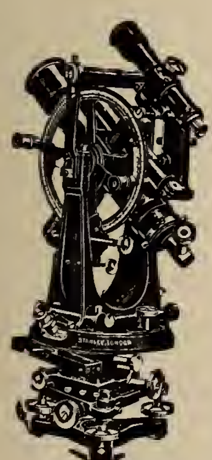

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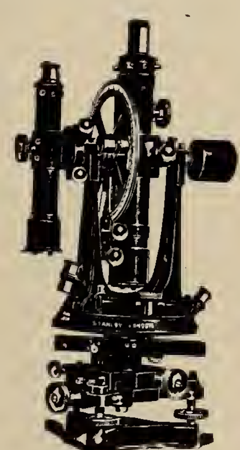

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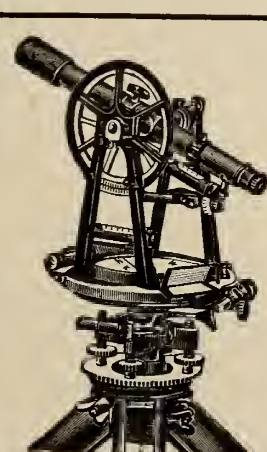

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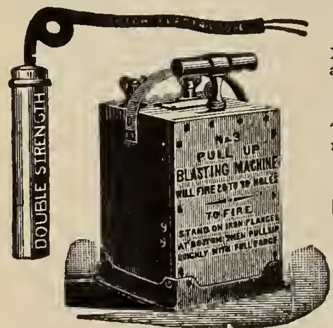

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CONTENTS.

Since the publication, in the July issue of the REVIEW, of a criticism of the flotation of the Nipissing mines, in Cobalt camp, the capital stock has been reduced from twelve millions to six millions. We think this was a wise change. We grant the Nipissing has made a very excellent showing, but six millions is a lot of money, and veins of rich silver ore have not always been remarkable for their permanence at great depth.

The REVIEW is not and never has been a party paper. It is perfectly immaterial to the mining industries of Canada which party is in power, either in the provinces or in the Dominion, so long as the mining law or laws are efficiently and honestly administered, and so long as there remains a disposition in the various governments to honestly advance the interests of the mining industry. In most cases the Government is well served, but it is notorious in Coleman that all official representatives of the Government are not above suspicion.

It is with much regret that we have to chronicle the devastation of the town of Haileybury by fire. On the night of August 20th, the greater part of the business section of Haileybury went up in smoke. The losses were fairly well covered by insurance, but, of course, will fall heavily upon the business men of that enterprising city. We are pleased to hear that most of those who were burned out will rebuild, showing that they have an unabated faith in Haileybury and its future. After all, most cities that amount to anything are either burned out or shaken up by earthquakes at some time or other.

The Geological Survey of the United States has published a volume on the methods and cost of gravel and placer mining in Alaska, written by Charles Wells Purington. The number of this Bulletin is 263, and all who are interested in placer mining would do well to obtain a copy of it, as it gives a very detailed description of the methods in vogue not only in the American camps, but the camps on the Canadian side of the line. The pamphlet is well illustrated and the particulars furnished of the different appliances and methods are accurate and trustworthy.

Owing to the number of prospectors who are seeking their fortunes in Northern Quebec, the original report by Dr. Robert Bell on the geology of the basin of Nottaway River, published as Part K, Annual Report, Volume XIII., was exhausted and a large subsequent edition has been heavily drawn upon by persons who are interested in that northern country. This report, while not as full as could be wished, is a very useful one, and considering that Dr. Bell only had an opportunity to make a reconnaissance survey, it contains a vast amount of useful information.

A very instructive paper on turbine machinery was read by Mr. S. A. Everett at the last annual meeting of the South Wales Institute of Engineers, when it captured the Massey prize. Mr. Everett takes a very optimistic view of the future of the turbine. It seems, however, that the highest authorities believe that while the steam turbine is a success the possibility of the development of the gas turbine in the near future is not bright. Some have gone so far as to say that the possibility of producing a successful gas turbine was only likely, provided there be first a revolutionary scientific discovery. In other words, the materials at the command of the engineer do not seem applicable to the construction of a turbine to deal with so high a temperature.

According to an article by Mr. H. C. Hoover, contributed to the *Engineering and Mining Journal*, of New York, the decrease of returns from Westralia gold mining during 1905, amounting to some 28,000 ozs., was largely caused by the conditions of the Australian mining title, by which a leasehold is granted subject to measurement. One man must be employed continuously for every six acres; thus the prospector found it impossible to hold his ground. The fear of inability to so do drove the prospector from the field, and throttled the growth of the industry.

Now, the colony is free from a labor government, and much may be hoped for in consequence.

This, probably, contains a lesson that our legislature should take to heart. If it was possible to strangle the growth of a vigorous industry, in Westralia, it would be certainly an easy matter to kill off an infant industry in any of our Canadian provinces. Next to mineral deposits, common sense mining laws are required in order to make a country flourish from the mining point of view.

Mr. Jas. Ashworth, M.E., read a paper recently before the North of England Institute of Mining and Mechanical Engineers, giving the results of his observations on water-sprayed or damped air in coal mines. The Council has shown its recognition of the value of this paper by awarding Mr. Ashworth a prize of two guineas. The value of such recognition does not, of course, depend upon the money value of the reward, but because it is a public acknowledgment of good, conscientious, intelligent work. For years Mr. Ashworth has contended that water-sprayed and damped air in dusty coal mines is neither a preventative, nor yet a controller of the extension of an explosion from one part of a colliery to another, and, although public opinion was for a long time against it, it looks as though his arguments were meeting with much less opposition than formerly.

The curse of all the new mining camps is typhoid fever. In the army it is known as enteric, but, though the names are different, the disease is the same. There was a considerable amount of typhoid in the camps of Northern Ontario last summer, and there is likely to be a further outbreak this autumn—spring and autumn being the two worst seasons, as a rule. There seems only one safeguard—boiled water. If a man is careful to see that every drop of water that comes into his shack is boiled, he reduces to a minimum the chance of infection. Our own system—and we have passed scathless through several epidemics—is as follows: A bucket is kept for the purpose of bringing water from the creek or spring, and this, after being emptied into a large pot, or boiler, which stands on the stove, is placed outside the door of the shack. Every drop of water that is used, either for toilet or for household purposes, or for cooking, is first boiled. If this simple precaution be taken infection can only be acquired outside the shack, and when an epidemic of typhoid is going through a camp, the man who values his health should be very chary of either eating or drinking away from his own table.

A system, now becoming a favorite one in the Slocan, of working old properties under lease, is one that might have a wider application. Mr. Geo. Huston, Editor of the *Mining Standard* of Sandon, has published a very interesting account of this system in the *Mining Record*. He states that a number of old properties have been taken in hand on low royalties. A few men club together, forming a syndicate, each man subscribing a certain amount and assessing himself at a small sum, monthly. In many cases the first assessment is one hundred dollars and the monthly dues ten dollars. This capital is managed solely by the investors, who keep close watch to see that all disbursements are for actual working expenses.

The labor is supplied by working miners, who go in on shares with the investors. Each party receives one-half the net profit, should there be any; the investing group paying for tools, outfits, powder and provisions, and allowing each miner one dollar a day. The miners are kept steadily at development, and any ore found is taken out by hired labor. A bank is selected to receive all moneys on account of the group and to make all payments, and to see to the equity of the division.

It appears to us that just such a plan would meet the needs of the small rich deposits that are likely to be found through Northern Quebec and Ontario. A few men drawing fair salaries can, by this system, get a run for their money, and stand a far better chance of receiving a good return than would be the case should they dabble in 5-cent and 10-cent stocks.

Most great inventions are simple, yet, surely, few can be simpler than that evolved by the clever managers of the De Beers diamond mines for saving the stones that pass through their hands. One of them noticed that oily substances, such as axle grease, or white or red lead, stuck to diamonds when they happened to come in contact with them. Hence, they argued, that diamonds should in turn adhere to grease. After a series of experiments it was ascertained that diamonds, alone, of all the minerals contained in the blue ground adhered to grease, the others drifting away as tailings with the water. The diamonds pass over a shaking table spread thickly with grease. The descending diamonds stick to the surface of the grease, while all the other minerals pass over it. Two tables are used, but only about one-third of one per cent. of the diamonds pass the first table, and those are found, with rare exceptions, upon the second table. Grease will catch rubies and sapphires and emeralds as well as diamonds, but it is not believed that it will cling to anything but a precious stone.

The grease which is used loses its power to retain diamonds after a few hours' work, when it is scraped off the tables, together with the diamonds adhering to it, placed in a kettle of finely perforated steel plates and steamed. The grease is used over and over again.

A modification of this method has been introduced still more recently by the Elmore Oil Process Company—but each really depends upon the affinity of gems for oleaginous substances.

A number of prospectors are now searching for diamonds in the northern parts of the Provinces of Quebec and Ontario, and these men all have frying-pans and abundance of grease derived from the mess pork they carry with them.

It may be possible that an ingenious man will make this hint of service in detecting the gems he is in search of.

MINING PROGRESS.

Each year sees improvements in the art of mining and metallurgy, so that ores that a few years ago were too poor to yield a profit in working, have now become available. One of the most notable metallurgical developments of recent years was the solution of the Broken Hill zinc problem, which resulted in the revival of the Broken Hill field. For many years tailings averaging 17 per cent. of zinc, 8 ozs. of silver, and 6 per cent. of lead, to the ton, were accumulated, until at length it was estimated that these old dump heaps contained some 6,500,000 tons of tailings. The wealth that was maintained in this immense accumulation tempted inventors so that some of the brightest brains were struggling to solve the problem, with the result that not one alone but many successful methods of treating these old tailings were discovered. These huge mounds have now but to be run through the treatment plant and zinc concentrates are obtained, which may be marketed or smelted. Unlike the great discovery of cyanide of potassium for the recovery of gold, the methods discovered for saving these zinc residues could not become monopolies. There were too many of them. Each successful inventor was forced to struggle with his competitors and to be contented with the smallest possible royalty. So the producers reaped the benefit—a benefit that was all the greater by reason of the high price of zinc, lead and silver.

The treatment problem having been solved, those companies which had dump heaps found they could sell them for large amounts of cash. After extraction of the zinc, the lead and silver become easily recoverable. The sulphur contents of the Broken Hill ores also assumed value in the form of sulphuric acid and superphosphates. Sulphuric acid is used for recovering the zinc in several processes and in the manufacture of superphosphates for manures. The following are the different processes for recovering the zinc in the Broken Hill ores:—The Sulman-Picard process of distillation of the zinc concentrates by treatment with ordinary bituminous coal; the magnetic separation process; the Potter and Delprat processes, in which sulphuric acid is used; the De Bavay carbonic acid gas process; and the Carmichael-Bradford desulphurizing process. All these processes are at work on the Barrier Range. It may be pointed out that the importance of a cheap supply of sulphuric acid will create a demand on the part of innumerable new industries to which it is essential. The applications to which sulphuric acid can be put are so universal that it has been suggested that a nation's industrial progress may be roughly measured by its consumption.

The next in importance of the ore treatment processes is the extended introduction of the tube mill. At the Waihi mine three tube mills as auxiliaries to one of its batteries are crushing and treating some 30 per cent. more ore than was formerly reduced without tube mills; the El Oro in Mexico is extracting 16 per cent. more gold by the aid of tube mills, and the appliance is being extensively employed on the Witwatersrand. At Kalgoorlie the Wheeler pan has been pitted against the tube mill, with the result that on this particular ore the advantage is claimed to lie in favor of the former; but in the matter of initial cost—two pans being taken as equal to one 13 ft. tube mill—the advantage is distinctly with the pans. The estimated cost of two Wheeler pans is £290, whilst one tube mill is calculated to cost £633.

The method of re-treating the residue dumps of the Randt, as originally carried on by the Crown Reef Company, has been extended to other mines. As every Randt mine which has crushed since the industry started possesses greater or lesser accumulations of residues, the recovery of the small amount of gold left in these at a fractional cost means a substantial addition to revenues. Last year the Crown Reef Company secured from this source alone a profit equal to 17 per cent. on its issued capital. Some 70 to 90 per cent. of the gold contained in these residues, representing from 3s. to 6s. per ton, is being recovered by a simple process of atmospheric oxidization and leaching out the gold with water. The residue heaps may consequently be made a not unimportant new source of revenue to Randt mines.

The old tailings dumps throughout the world have been bought up by cyanide operators, until very few now exist. Practically all the old dumps on the Randt, Charters Towers, Victoria, West Australia, the United States of America, and Mexico are exhausted, having added millions of gold to the wealth of the world. Cyaniding is now, therefore, practically confined to the tailings and slimes as they come from the mill; and, with the use of tube mills, the intermediary product of tailings will be done away with, slimes only being left. There still remain very large old dump heaps of tailings from the silver mills; but, except in a few instances, the treatment of these has has not proved a commercial success, as the extraction of the silver values generally does not exceed 50 per cent. Of course, this does not apply where the tailings can be smelted. I, however, anticipate that these enormous piles of tailings in Mexico and other countries will become amenable, as the Broken Hill residues now are, to some process which will give a profitable rate of extraction. A fortune awaits the metallurgist who successfully tackles this problem.

Very considerable progress has been made in gold dredging, the simplest form of gold mining. In this case Nature has already done the mining by disintegrating the gold-bearing rocks and concentrating the gold into payable quantities in alluvial drift, so that it may be dredged up in an easily recoverable form. The introduction of this class of mining has made rapid strides during the past year, more particularly in the various South American territories, West Africa, Siberia, and the Western States of America. The experience gained in dredging methods and in dredge construction in New Zealand has been carried into other countries, and this phase of gold-mining presents the prospect of becoming more profitable than it has ever before been. In California the increased yield last year is mainly set down to dredging operations. No dredging area, unless it is a rich one, will stand a large capital. In New Zealand the vendor's and promoter's interests do not exceed one-fifth the total capitalization; the balance forms the cash working resources for equipping the property.

In the milling of ores the weight of the stamps has been increased to 1,350 lb. on the Randt, and in other cases to 1,500 lb. The tendency is by the use of preliminary ore breakers to feed a much smaller size of ore into the battery, and to run a much coarser grade out of the battery, leaving the auxiliary tube mills to complete the grinding to any degree of fineness required. In this way the duty of the stamps is very largely increased. The Wheeler pan is also coming into use as a subsidiary in fine grinding. In certain classes of ores dry grinding by roller mills, etc., has proved an economical success. More attention has been given to the re-crushing of concentrates, but either tube milling or the use of Wheeler pans get over this difficulty. Many additional mechanical contrivances for facilitating work have been introduced, such as the mechanical "mucker out," the steam shovel, various forms of ore conveyors, both over and under ground, the application of electrical energy for lighting, trolleying, hauling, pumping, crushing, and, in fact for all purposes where power is requisite. In this connection water power is being utilized as a generating force at great distances from the centre of application. Then there is the marvellous progress in the various systems of producer-gas plants, and the newer types of electrical pumps, which take up less room in the shaft, are less expensive than the old variety, and deal with immense quantities of water at a fractional cost. The progress of metallurgy has been equally great in the different thermo-electrical processes for the smelting of ores and the manufacture of steel. In copper smelting, plants which were considered up to date five or six years ago have been so improved upon that it pays to scrap-heap them in order to use the latest appliances, giving better results at a great reduction in working costs. The more extended use of the filter press in the case of special ores has overcome treatment difficulties.

Advances have also to be recorded in the use of water-tube boilers, developments in the steam turbine, the standardization of mining machinery, the centralization of plant for a group of mines, the centralization of electrical power transmission, the provision of a central workshop for a group of mines and a central station for purchasing all the requisite supplies—such as foodstuffs, coal, timber, explosives, etc. On the Randt there has also been a tendency to enlarge the area under one management and so curtail administrative expenses, likewise to develop the enlarged area by fewer shafts, especially in the deeper level ground. I particularly notice the tendency in mining engineering to employ specialists, and, where there is such a variety of highly technical subjects to deal with, as in gold, silver, copper, tin, lead, zinc, etc. in all forms and combinations, the cheapest method in the end is to employ the best specialist on each subject under consideration. Reduction in treatment costs has made satisfactory progress during the year. The new and up-to-date methods for more economically handling and treating the ore are doing away with the uncertainty and chance which have in former times characterized the mining industry. Low grade ores, which a few years ago could not be mined at a profit, are now extensively worked, and treatment plants are being remodelled to meet the special requirements of each description of ore. Refractory ores which baffled the mining experts of a few years ago are now made to respond readily to treatment processes. Mining is, therefore, becoming more popular year by year. Where conducted on the honest, prudent and common sense lines recognized as requisite for success in other businesses, legitimate mining enterprise, under the guidance of well trained managers and engineers, is more profitable, on an average, than any other line of business.

Attention must be called to the fact that many of minently to the front during the past year, and continues to receive great attention—as it deservedly should in the process of placing mining upon a sound business basis. No ore ought to be considered to be in reserve unless blocked out on at least three sides, and the smaller the blocks are the more accurate will the estimates be.

I again draw attention to the fact that many of the goldfields of the world have either reached their zenith or entered the declining stage, whilst many mines have attained such great depth that their end can only be a matter of a few years. It is natural to expect the shares of such companies to decline in market value in proportion to the depth reached and the amount of gold taken out of the mine; but in practice this is seldom the case. So long as a mine yields 10 to 12 per cent. on the current quotation, that alone satisfies the average mining shareholder. There is too much inclination to consider mines as investments. This is particularly dangerous in cases where great depth has been attained, and the more so where the profit in the ore reserves is considerably below 60 per cent. of the market valuation of the company's capital. Of course, in cases where 60, 70, or 80 per cent. of the current market price is represented by profit in the ore in sight at the date of purchase, shares assume more the character of an investment, but even then a careful watch must be kept to see that the profit in the new ore developed is sufficient to replace that being crushed month by month. As this, however, is usually impossible—sufficient data being only given annually—the speculative element has to be reckoned with even in the limited number of first-class mines, authorities hold that no mines should be considered investments. They are speculations, and should be treated as such.

THE AMALGAMATION OF GOLD.

The bi-monthly bulletin of the American Institute of Mining Engineers for May, contains several articles of interest to mining men. The amalgamation of gold ores was the subject treated of by Thomas T. Read, and we understand this paper was also to be read during the July meeting in London. Its contents may be summarized as follows:—

1. Gold absorbs mercury, forming a solid solution which may contain as much as 13 atomic per cent. of mercury. Beyond this, an inter-metallic compound containing gold or mercury in solution (or a second solid solution) is formed, which contains 17.5 atomic per cent. of mercury. Ordinary amalgam, which is not in a state of equilibrium, consists of one or both of the foregoing, usually the former, mixed with an excess of mercury which coats the particles and causes them to cohere.

2. Amalgamation is a physical process, the chemical actions involved being chiefly inimical (excepting those purposely induced). The gold grains are wetted by the mercury and sink beneath the surface of the mercury film on the plates; this is facilitated by feeding mercury to the stamp, so that the grains may be thoroughly wetted before coming in contact with the plates. The disadvantages of this procedure have already been discussed. The surface-tension of the mercury draws the gold beneath the surface, and holds it against the plate. By diffusion into the metal of the plates the amalgam often becomes strongly adherent. Silver-plating is

useful, because it prevents the solution of the copper in the mercury, and, therefore, the harmful chemical reactions that result therefrom. Muntz metal plates exhibit the same effect, and, in addition, diffusion of amalgam into them is very slight, so that it is readily removed. Silvered-plates will hold a thicker film of mercury than plain copper, and plates coated with gold amalgam a thicker film than either. This assists the "catching" of the gold.

3. Variations in temperature make themselves felt in slight changes of a number of factors rather than large changes in any one. According to the relative importance of these factors in each case the total effect may vary. The most important undesirable effects of raising the temperature are the increased solubility of harmful salts, and a corresponding increase of the precipitation of base metals into the mercury; this both hinders its proper action and leads to its loss. Rise of temperature also diminishes the surface-tension and viscosity of the mercury, which allows it to be more readily "floured." The force with which the gold is drawn beneath the mercury and held against the plate is also decreased. On the other hand, by an increase in temperature the wetting of the gold by the mercury and the "catching" of it by the plates is facilitated, as is the coalescing of the globules of mercury.

4. Increase of temperature causes increased absorption of mercury by the gold and by the plates. Changes in temperature cause changes in all the foregoing factors. The retaining of a constant temperature is, therefore, most favorable to successful working. A comparatively low temperature is better where the influence of soluble salts in the ore has to be considered (which is usually the case); but when this may be neglected, as high a temperature as can economically be maintained, without variation, is most favorable to successful amalgamation.

THE UPPER STEWART RIVER, YUKON.

In the early eighties bar-mining was practised to some considerable extent on the lower portion of the Stewart river, but the upper waters of that river are practically unknown, except for such information as the Geological Survey has supplied through the medium of Mr. R. G. McConnell in 1900, and Mr. J. Keele, whose report on his explorations of last year is now being published.

That these upper waters do not traverse the desolate region one might suppose is plainly seen by a glance at Mr. Keele's report. He says "the long hours of daylight are favorable for abundant vegetation," and that trees—among which are spruce, balsam, poplar, and birch—grow to heights of nearly three thousand feet above the river. Wild fruits grow in great abundance and "the region offers a great field for the sportsman and explorer." Several species of bear are found in the region, wolves and wolverine, moose, mountain caribou and mountain sheep. Of the fur-bearing animals, there are lynx, fox, beaver, marten, otter and mink.

The part, however, of Mr. Keele's report that will be read with greatest interest is included in the paragraphs on economic geology. After describing the various rocks of the region, the author goes on to remark that "the bed-rock of all the productive placer ground in the Yukon Territory is of a similar character to the above," a hint which, to those prospectors who read between the lines may be of great value. Mr. Keele found gold "in the gravels of many of the small streams flowing over this area," but is naturally careful as to inciting false hopes and adds "whether there is sufficient gold to pay for mining can only be determined by the usual process of reaching bed-rock."

The physical features of the district make interesting reading. We learn that the "scenery is very fine and the mountains gain impressiveness from their situation in low, wide valleys, and their coloring is rich and varied. Some of the valley bottoms seen from a height have an extraordinary appearance, suggesting a mosaic floor in which the pattern is worked out by the bright surfaces of the countless ponds and the narrow dark-green land areas separating them."

SAFETY IN MINING.

The prevention of accidents in mining, is a matter that should be always under consideration by the mining engineer. The subject was, we think, well dealt with by Messrs. Donald Macaulay and Lewis G. Irving, in a recent paper contributed to the Journal of the Chemical, Metallurgical and Chemical Society of South Africa. Prevention is better than cure, and in the paper under consideration, the authors endeavor to point out the principal causes of loss of life through "gassing," and the means of avoiding it. The paper was, in part, as follows:

By the courtesy of the Acting Commissioner of Mines we have been permitted to examine the official reports of the fatal accidents due to "gassing," into which investigation was made by the mining inspectors, for the two years 1904 and 1905. We have gone through these returns very carefully, with a view to determining the general conditions under which these accidents happened.

Thirty separate fatal accidents occurred during that time. They involved the death of nine white men and thirty-one natives or coolies, and the serious "gassing" of some twenty-four others. Seventeen of these fatalities were clearly preventible. Returning to the working place too soon after blasting accounted for some, but only two white men were found culpable in this respect, and both lost their lives; others were due to neglect on the part of the white miners to take proper measures to see that the working places were safe before setting the boys to work; others again to carelessness in the handling of explosives leading to their ignition. Twenty-three of the forty deaths were, broadly speaking, due to misadventure, but these included a considerable number due to mere ignorance, and a few where lack of supervision seemed certainly to be a contributing cause. A few were caused by exposure to fumes arising from blasting affecting those at work in neighboring parts of the mine.

Of the forty deaths the records point to nitrous fumes as having been the cause of death in seventeen cases, in at least eight of which the diagnosis is definitely stated to have been confirmed by post-mortem examination. All of these were characterized by the same clinical symptoms; no serious disability at the time of exposure, a latent interval frequently without apparent signs of anything being wrong, and then the onset several hours later of an acute and almost invariably fatal illness. Naturally enough in non-medical reports like these the symptoms of illness are not always detailed; where they are so in such cases they are those of the acute respiratory distress characteristic of poisoning by nitrous fumes. In the other twenty-three cases, on the other hand, carbon monoxide was apparently the predominant poison, although in a good many of these carbon dioxide was also present. "Gassing" from nitrous fumes and carbon monoxide conjointly appears to be rare, for reasons which will presently be stated, although it certainly may occur under special circumstances. Clinically the cases fall, with very few exceptions, into two quite distinct categories, poisoning by nitrous fumes and poisoning by carbon monoxide or by a mixture of the latter gas with carbon dioxide. It is of interest there-fore to arrive at some conclusion as to the different circumstances under which these different types of "gassing" occur.

Let us take first those instances in which the explosive was ignited and burned, or burned and then exploded. During the period under review, there were five cases of this sort, causing in all six deaths, and in all but one of the latter "gassing" took the tpyical form of poisoning by nitrous fumes. This fact, however, must not be taken to indicate that there is no danger in these cases of poisoning by carbon monoxide, for it has, of course, been abundantly proved that when nitro-glycerine explosives are burned both CO and NO are evolved in large quantity. The result is rather due to the fact that people very naturally do not, as a rule, stay long enough in the neighborhood of burning explosives to run any great immediate risk of poisoning by carbonic oxide. There is a hasty stampede to a place of safety. In one of the six fatal cases, however, the post-mortem appearances seemed to point to a mixed poisoning, and during the present month a most striking and deplorable instance of this nature has occurred, resulting in the loss of fifteen lives. It is worthy of record.

A gang of thirty natives, under a white miner, were proceeding to their working place in a stope, The natives arrived first, some descended the stope, the others, fourteen in number, remained on the level above, in which, between them and the station, was the miner's dynamite box. The miner followed, and had reached his box and passed it, when immediately an alarm was raised; fifteen, perhaps twenty, pounds of gelatine dynamite contained in the box had become ignited, apparently, so far as the facts are obtainable through the carelessness of the miner. The boys in the level rushed towards the station, right into the fumes, and all collapsed at once and dropped within a short distance of the box, where their bodies, and that of the miner, were afterwards found. The natives in the stope below the level escaped. Exposure was thus immediate, and apparently death was equally so. The blood from three of these cases was examined in the Government Laboratory, In each case it was cherry red in color, and uncoagulated. It contained a high percentage of carbon monoxide, and the chemical evidence is stated to point also to an "oxide of nitrogen," as a contributory cause. Clearly, here, the proportion of these gases in the air at the moment, no doubt in conjunction with carbon dioxide also, was high enough to produce immediate unconsciousness and death, and the case may be regarded as one of mixed poisoning; although, probably, the proportion of CO by itself and of NO by itself may have quite well each been high enough to account for what happened.

In four instances in the reports of these two years, the examining mining inspector was inclined to think that the explosives had partially burned. In two of these, exposure to the gases did not occur till several hours afterwards; in each case a white man and a native lost their lives; in one instance, quite certainly, from carbon monoxide poisoning, for the bodies were found in a winze, with the candle of the white miner burning brightly beside them, and the post-mortem appearances corresponded; in the second, also, death was probably due from the same cause. In the other two instances, exposure was immediately or shortly after blasting, when "gassing" took the form of poisoning by nitrous fumes. The evidence on which the opinion of "partial burning" of the explosives having taken place is based is not in all these cases conclusive, but this need not concern us, since, so far as the relation between the conditions of exposure and the form of "gassing" which ensued is concerned, they fall quite into line with those which follow.

There remain, then, twenty-one instances in which "gassing" occurred after an apparently normal explosion, and in six of these it was due to poisoning by nitrous fumes. There were nine deaths and two recoveries. It is of interest to note that, in those where special investigation was made, no carbon monoxide was present in the blood. In one of these six instances there was no exposure to the fumes until two hours after blasting; in all others the exposure was immediately after the explosion had taken place.

One or two points are worth noting in respect to the circumstances under which poisoning by nitrous fumes occurs.

First, the exposure is typically immediately after blasting. Within an hour or so this special danger seems almost invariably to disappear, a fact which is, no doubt, due to the ready solubility of the gas concerned. Second, the duration of the exposure is often extremely brief. Third, it may occur at considerable distances from the actual seat of generation of the fumes, and the latter may affect one or two only out of a working party of several apparently equally exposed. Blasting in one portion of a mine may thus affect those working at the time in other portions, even at some little distance. It would appear from this that the amount of gas which may produce fatal poisoning may be very small. We have met with one case at least, as we stated in our last paper, where a white miner died from characteristic acute haemorrhage oedema of the lungs, without even having been aware that he had been "gassed" at all.

One of the most striking cases of "gassing" by nitrous fumes occurred in an accident which happened on one of the mines on the West Rand in May, 1905. It presents several features of interest which make it worth recording.

A box containing 30 lbs. of gelignite in a blind drive, eighty feet from the 10th level station, was observed to be burning. It exploded immediately after, causing 30 lbs. of blasting gelatine, twenty feet away, in another box, to explode also. A 6-gallon tin of paraffin at the station caught fire at the same time, and simultaneously the explosion broke a 6-in. air-pipe, allowing the compressed air to escape freely. A shift boss, two white miners and several coolies were at the station when the gelignite caught fire, and they immediately rushed into the drive on the opposite side of the shaft. The explosion and the flames overtook them, they were thrown down, burned and battered, and so severely that five coolies died later from their injuries. They lay there afterwards for a considerable time, but they were not "gassed." The bulk of the fumes seem to have mounted the shaft, and some passed along the 7th level, where the mine captain and a miner encountered them, 1,200 feet away from the seat of the explosion. They both felt the fumes, and the miner complained of feeling sick. He went to the surface, then returned underground, but had to go back. He died the same night of acute oedema of the lungs, the accident having occurred in the forenoon. None of the others were seriously affected by the fumes.

In the other fifteen instances (with nineteen deaths), also occurring after apparently normal explosions, poisoning appeared to have been due to carbon monoxide, with probably also in many cases, and certainly in some, an admixture of carbon dioxide. These accidents occurred in the dead ends of drives, in winzes or in rises, where air had been allowed to stagnate after blasting. In only one instance was there exposure immediately after the explosion; this was in a case where a white miner had recklesly returned with a native to the working face to blast the round very shortly after blasting the cut; both lost their lives. In another instance there was exposure half-an-hour after the explosion. In all other cases two hours or more had elapsed, in one as much as twenty-six hours. In several of the reports definite statements are made as to whether the candles of those affected, or their rescuers, burned in the usual way or not. Mention is made of this in eleven cases; it is a point which should invariably be particularly inquired into, although reliable evidence is not always to be had. In six cases the candles burned brightly, in one dimly, in four others they were extinguished, but in one of the latter instances three of the rescue party were afterwards rendered unconscious, although their candles by that time were burning perfectly well.

Clearly, it is difficult to accurately apportion the respective influence of carbon monoxide or carbon dioxide in many of these cases. It is probable, judging from the results of systematic analyses of mine air after blasting, that 2, 3, 4, or even as once happened in Mr. Mann's series, perhaps 7 per cent. of carbon dioxide may be present locally in the air after explosion, and while the smaller quantities mentioned would of course in themselves be insufficient to produce unconsciousness, they would unquestionably aggravate or accelerate the effects of any carbon monoxide present, especially in the presence of a decreased percentage of oxygen. On the other hand, even in cases where the candles of those affected burned as usual, and where the amount of carbon dioxide was therefore under 3 per cent., one reads of those affected being rendered unconscious "within a few minutes," and it is probable, therefore, that under such circumstances carbon monoxide was present in amounts perhaps approximating to 0.5 per cent. or more. These facts go to show that this gas is certainly frequently, and probably almost invariably, the predominant agent in producing a fatal issue under such circumstances. Unfortunately, spectroscopic examination of the blood of those affected was not frequently undertaken, but in the instances in this series in which this was done the results were positive. Take for example such a case as the following: A miner blasted the face of his drive at 10.30, turned on the air and went to dinner. He stated that he warned his boys to wait till he came back. He returned two hours later and found one of the natives lying dead on the broken rock with his candle burning beside him, the compressed air being still on the "outbye" side of the broken ground. The laboratory report stated that the blood contained "a large percentage of carbon monoxide." It would be tedious to multiply instances, the general conclusion is plain enough. One further point, however, is worth noting, namely, that in none of these cases, where those affected were disabled or rendered unconscious at the time and recovered, did symptoms of superadded poisoning by nitrous fumes afterwards appear to supervene.

Several matters arising out of this particular group of cases deserve consideration. First, apart from cases of burning, carbon monoxide poisoning is, as we said, typically due to the stagnation of air in close places after blasting. It is, therefore, very necessary to prevent this by adequate ventilation, the more so as the cases we have quoted do not include the more numerous minor cases of "gassing," which are not reported to the inspectors, and which, although they do not contribute to the death-rate, do certainly contribute practical evidence as to the degree of vitiation of the working air. In all drives or winzes or rises, where development is being carried on some distance beyond the main air ways, ventilation other than the means ordinarily in use should be provided, in the form for example of the James' "water blast," which we shall describe in a moment, and of ventilation by pipes fitted with a reversible air jet, which can be used to propel air into the working places during the working time of the shift and extract it after blasting. These measures are recommended both in the English "Report on the Health of Cornish Miners," and in the "Report of the Western Australian Commission on the Ventilation and Sanitation of Mines." The latter contains a description of a simple arrangement of ventilating pipes in drives, designed to meet the difficulties of risk of injury from blasting.

In addition, any breach of the regulation regarding the proper examination of the working places by white gangers, prior to setting natives or coolies to work in them, should be severely punished.

Second.—One reads not infrequently of rescuers, working with misdirected heroism, being themselves "gassed," in one of these instances fatally so; one reads of deaths from inability to reach the affected persons in time, or from lack of skilled treatment on the spot after their extrication, facts which strongly accentuate the urgent necessity for the provision of effective rescue appliances, and for a more adequate knowledge on the part of mine officials and workmen of how to deal with cases of "gassing," on which we have already insisted.

Third.—We have noticed that in several instances it has been stated that boys have been set to shovel broken rock, and after working for some time, sometimes for several hours, have been overcome and found unconscious, or perhaps dead. There is no doubt that the broken rock tends to imprison the gases and that their subsequent liberation in shovelling may become dangerous in close places. And here again we see the necessity of more effective local ventilation, and of more continuous supervision on the part of the miners of work of this nature.

The question remains—are we to regard these cases of "gassing" as due to explosions which are exceptional in their nature, involving a partial burning of the explosives which does not normally take place? There is nothing wholly incredible in this supposition, for the number of cases of "gassing" is certainly small in proportion to the enormous quantities of explosives in use.

The origin of the explosives used in these cases of course differs considerably, and although the particular manufacture employed is not always specified in the official reports, it is clear that accidents may occur with one as much as with another. The composition of the explosives in local use also varies greatly, blasting gelatine, gelatine dynamite, and gelignite are all employed, and even of the gelignites, some of which are so named are as powerful as the ordinary standard of gelatine dynamite, while in others the active constituents form a rather smaller proportion than in the ordinary standard composition of gelignites.

One is left with two alternatives. Either the dangerous evolution of fumes of carbon monoxide and nitric oxide is due when it occurs to partial burning of the explosive, and this occurrence is exceptional, or even in normal explosions, the explosive decomposition is not theoretically perfect for the whole or part of the explosive, but commonly results in the production of varying quantities of these gases.

We have not as yet sufficient data to decide this question. We know how nitro-glycerine and nitro-cotton behave when exploded and when burned, but as we do not yet accurately know what actually happens when these variously constituted nitro-glycerine explosives are exploded under ordinary working conditions. It is very probable that under ordinary circumstances, especially with gelignites, the evolution of varying quantities of NO and CO is quite common, even when the shots are fired apparently quite satisfactorily. In other words, if perfection of explosion be defined as the production at the time of explosion of no deleterious gases other than CO_2, it is probable that under ordinary working conditions an imperfect explosion is really not uncommon.

Mr. E. A. Mann has published in an appendix to the Western Australian Commission's Report the results of a careful series of experiments, undertaken with a view to determine the causes which might lead to the partial burning of explosives. This result, so far as his experience went, he did not find to be traceable to defects in the explosives themselves, there was no difference in different brands, and age up to two years made no difference either. He believed that careless storage of detonators, allowing of their deterioration, may be the cause in some cases, the only other cause revealed was burying the detonator too deeply in the charge, which may produce combustion through spitting of the fuse. The ordinary method of tamping he found to be sufficient, overcharging did not seem to affect the character of the fumes, and there was no obvious difference in results from the use of different sizes of detonators, which could be attributed to this factor alone. Nevertheless, all detonators should have full strength.

II.

The gases which are formed from nitroglycerine explosives are important, not merely in occasionally producing "gassing," but in the constant influence they exercise in contributing to that vitiation of the general body of mine air by particulate and gaseous impurities, which is the most important cause of the unhealthiness of the miner's occupation.

Many of you will remember the great battle we had a couple of years ago in this Society, over the question of how far the vitiation of mine air by gaseous impurities contributed to the causation of the mortality amongst underground workers on the Rand, and to the production of "miners' phthisis." Mr. Heymann was the great protagonist of the "gaseous" view, and particularly of the theory that chronic carbon monoxide poisoning was probably the main causative factor involved. We ourselves, and the other medical men who took part in that enlivening discussion, held to the conclusion that dust was the chief primary factor in the production of the lung diseases of miners, although we agreed that constant dosage with sub-toxic quantities of carbon monoxide and nitrous fumes must also be reckoned as an important contributory factor in their causation. To this opinion we still adhere, while we admire the acumen of many of Mr. Heymann's contentions, and admit the force of some.

It is hardly necessary to resuscitate at much length that old discussion. It is to respiratory disease of a chronic type that the high occupational mortality of metalliferous miners all the world over is admittedly due, and there are three main factors which go to the causation of this respiratory disease. These are dust, infective processes, and gaseous impurities. And here we may say a word regarding the use of the term, "miners' phthisis." As we have said, the form of lung disease from which miners typically suffer, and which is due to the peculiar risks of their occupation, is a chronic one. It is characterized by a progressive fibroid consolidation of the lung tissue with accompanying catarrhal processes, and, while its onset is extremely insidious, its termination is often painfully rapid. It is to this condition, then, that the name "miners' phthisis," is applied, and personally we think the term is both suitable and useful. But it must be thoroughly understood that this term is primarily a clinical one, and carries with it no presuppositions as to its causation or its pathological nature. The chronic lung diseases which one meets with among miners, and which one includes under the term miners' phthisis, have in common the clinical features which we have mentioned. But even in clinical type they present several varieties, which are due to the preponderance in individual cases of one or other of the main causative factors, which contribute to the pathology of the disease. And, therefore, if we may usefully group the chronic lung affections of miners, which are characterized by these common features, and which are due to causes incident to their occupation, under the one name "miners' phthisis," we must at the same time admit that the term does not describe a specific disease due to a single causative factor, but is a name carrying implications which are primarily clinical and which does not exclude the possibility of there being more than one agent concerned in the production of the pathology and symptomatology of the disease. If this is thoroughly understood, the use of such a general, and, pathologically speaking, indefinite term as miners' phthisis is not only defensible but useful, if only to emphasize the fact that few cases of chronic lung disease occurring in miners who have spent many years underground are of quite unmixed causation, or are the manifestations of a single uncomplicated pathological process.

The prevention of "miners' phthisis" is one of the most serious public health problems with which we in this country have to deal, for the mining community it is the most serious health problem. And, therefore, we propose to take up each of these contributory factors which we have named seriatim, and to discuss what may in each case be done in the way of preventing or mimimizing their effects.

The first factor is the dust produced in the drilling of rock by machine or by hand, in blasting, and in shovelling or handling the broken rock. The dust produced by drilling by machines is of the first importance, since rock-drill miners are the heaviest although not the only sufferers from lung disease.

ALONG THE G.T.P.
On River Crôche, a tributary of the St. Maurice.

ALONG THE G.T.P.
Lake Coocoocache, where the Hudson's Bay Company have a fort.

Some time ago we concurred in the opinion of the Chamber of Mines Committee, that in principle the water-drill, a drill, that is, which delivers water as part of its ordinary operation at the end of the drill, was the best means of laying the dust so caused. The trouble is that no such rock-drill is yet on the market which can be recommended for general use. The Leyner drill is the nearest approach to the successful application of the principle, and it does good work, we believe, in rises, but it requires a high pressure and it is costly in maintenance. This being the case, the Committee gave the first prize to Mr. Britten's atomizer. But there are objections to the atomizer in the supersaturation of the air which it causes; a supersaturation which, while somewhat objectionable even if the water employed were pure, is decidedly so when impure water is used. A jet, delivering water into the hole while successful in laying the dust, is apt to give trouble in working by causing the dust to cake and the drill to jam. We are inclined to think that the most generally useful device, which depends upon water, is a coarse spray kept playing at the mouth of the hole. It lays the dust, if a little care be used in occasionally cleaning the mouth of the hole it does not choke, it consumes less water than the jet, and while it may increase the local humidity of the air it does not supersaturate it. For such a spray as for the atomizer, the power can be obtained from the compressed air, as in the case of the atomizer also it is desirable that a supply of water free from organic contamination should be employed. The nozzle of the spray may be usefully of a type to give a rotatory movement to the water.

In hand-drilling it is more easy to control the vitiation of the air by dust. The amount produced is very much less, and the spaces in which work is done are much less confined. If water is used, the amount of dust produced, once the hole is well started, is slight. But one's observation does not go to show that a sufficient supply of water to allay the dust is consistently used in this process. And, further, it is seldom remembered that a considerable quantity of dust is produced in starting the holes, before these are deep enough to hold water. Thomas and McQueen found that as much as 4 mgrm. of dust per litre of air was present in the air at the turner's mouth at the starting of a hole, which is as high as the average of dry holes drilled by rock drill. They recommend that a wet sponge squeezed against the drill in holding it should be employed at the start, and as sponges are expensive no doubt a simpler substitute could be found.

The dust produced by blasting is also a matter of great moment. To allay this, probably no better device can be used than the James' "water blast," the principle of which is to employ the pressure of the compressed air to project into the face immediately after blasting a quantity of water. The mechanism is simple, and its use and effects are thus described in Haldane, Martin, and Thomas's "Report on the Health of Cornish Miners."

"We find that the following plan, devised by Mr. William James, underground agent at Dolcoath, is very effective in quickly laying the dust and diluting the gases. At the mouth of the level a piece of 6 in. iron pipe or a small cylinder, provided with a side tap, is let into the ordinary 2 in. pipe for carrying the compressed air for the drill. Before the blast this is filled with water through the side tap from a cistern, after the compressed air has been turned off. Immediately after the blast the compressed air is suddenly turned full on. The water is thus driven along the pipe with great velocity, and a mixture of finely divided water and air is discharged from the open end, which is directed towards the face which has just been blasted. By this means the dust is entirely cleaned from the last 30 or 40 ft. back from the blast, the air leaving quite clear immediately after. If a ventilating pipe is carried forward about as far as the compressed air pipe, any dust which has been driven out beyond the reach of the jet can be rapidly carried off. This plan has the great merit that it requires scarcely any trouble, and no extra apparatus except the 6 in. pipe and the tap for filling it. The rock blasted is also thoroughly wetted so that no dust is produced in shoveling it. The water partially washes out from the air any nitrous fumes which may be present, but, of course, not carbonic oxide, and for this reason, if no other, a ventilating pipe is desirable in cases where the level or rise has been carried a few fathoms beyond the air current."

The water blast, as this statement shows, not only allays the dust most effectually, but is in addition very useful in diluting and removing nitrous fumes; it reduces the percentage of carbon monoxide also, "partly owing to the fresh air thrown in with the water and partly to the effect produced in mixing the air of the level or rise with the products of combustion." We believe that this mechanism has been already used in isolated cases on the Rand. It is very desirable that its use should be greatly extended in drives, rises and winzes, since it is through stagnation of air in these places that "gassing" accidents commonly occur, for the prevention of which the general method of turning on the compressed air in the ordinary way is clearly not always effectual. The use of the water blast should be supplemented, as we have said, by that of the air-jet.

The dust caused by shovelling and handling the broken rock is also considerable. Where the water blast is applicable, no further means is necessary, where it is not, means should be taken to wet the rock.

Pace Mr. Heymann we may grant we think that in all true cases of miners' phthisis, dust with its direct consequence in silicosis is the primary causative factor; silicosis is the feature common to them all. Of the secondary factors there comes first what we may term the infective factor. The chief infective process which complicates these cases is of course tuberculosis. When shortly after the recommencement of work upon the mines after the war, we first systematically investigated this question, we came to the conclusion that tuberculosis was present only in a minority of cases of miners' phthisis. At that time we certainly saw a much greater proportion than we do now, or we think, than we did before the war, of the pure "dry" form of miners' phthisis, which is typical of silicosis uncomplicated by superimposed infection. This experience was not in harmony with that of Dr. Haldane and his colleagues, who recently reported on the causation of the high mortality from lung disease amongst Cornish miners. They concluded that of the cases of lung disease in miners "probably at least two-thirds, including all cases of so-called miners' phthisis, were to be looked upon as in reality of a tubercular nature," and a considerable proportion of these cases were men who had worked in the Transvaal. We believe that this conclusion was to sweeping to represent accurately the conditions on the Rand at the time, although our present experience approximates more closely to it than did that of three years ago. We believe that at present on the Rand the majority of cases of miners' phthisis do end up with tubercular infection, although we still, undoubtedly, meet with a minority of cases of the pure "dry" type, which appear to be from first to last non-tubercular in character. Given a certain development of silicosis, some intercurrent illness, pleurisy, pneumonia, influenza, or a severe "cold," may be the starting point of the infective process, or it may develop more insidiously. Some cases, no doubt, are tubercular from the beginning, but the mining life of those so affected is a short one. These are not cases of miners' phthisis but of ordinary phthisis in a miner. Pneumonia is characteristically slow to clear up, to "resolve," as we call it, where silicosis is present, it is very apt to persist in the form of a chronic catarrh, which may eventually become tubercular. And, apart from this, localized areas of catarrh, apparently so far as clinical and bacteriological observation goes, non-tubercular in character are commonly met with; they often clear up satisfactorily under treatment. Under ordinary working conditions then we believe that the majority of cases of miners' phthisis do in the end become tubercular. If they do so, the downward progress of the case is usually rapid. Now in this qualification under ordinary working conditions we have, we believe. the explanation of our past experience. The condition of affairs, when we first came to investigate the subject, was not ordinary. The war had caused an interruption of mining work for the miners of two or three years' duration, and it is very likely that many men, in whom fibrosis of the lung was already well developed, escaped as a consequence of this interruption the terminal infection which they might otherwise have contracted. Nothing was more striking than the manner in which in many instances men who had served in the field with good health during the war quite suddenly began to go down hill on resumption of mining work. Their lungs were so far crippled that, although under the favorable conditions of service on the veldt, their health was well maintained, the balance tipped fatally against them on renewed exposure to the irritant effects of the vitiated underground air. And many of these men died without any clinical or bacteriological signs suggestive of tuberculosis.

Perhaps many of you may think that this point is of merely medical interest. But the heavy incidence of tubercular and fibroid phthisis amongst our natives and the signs of a recent increase of the infection amongst whites, suggests a "safety measure" of much importance, namely, strict examination for cases of tubercular phthisis before the natives enter the country, in the detention compounds, and on the mines. To a large extent this is done already; what we should urge is that this process should be carried out with the utmost degree of thoroughness, and that every native proved to be suffering from tubercular phthisis should be absolutely prohibited thereafter from working underground.

The same question arises with regard to white workers. The West Australian Commission definitely lay it down as a recommendation that no white worker proved to be suffering from tuberculosis of the lungs should be allowed to go underground. For the affected man to continue underground work is merely suicidal, and for his mates the risk of working in close places in company with anyone affected by tuberculosis is certainly a definite one. We would urge therefore that the Government should seriously consider whether it would not be wise in the interests of all concerned to follow the recommendation of the Australian commissioners. The proved necessities of public health must override individual interests, and in these cases the interest of the individual, so far as his health is concerned, coincides with the public interest. No doubt, it must be regarded as a hardship to compulsorily debar a man from following his occupation, but the step would only anticipate by a few months, or at the most by a year or two, the final irrevocable compulsion of the disease itself, should the affected man persist in following his occupation. That this measure would greatly prolong the lives of those already affected by advanced tuberculosis we do not asert, but in early cases of tuberculosis when a slight or moderate degree of silicosis was present, it might certainly do so. But if this step be taken the community must see to it as an equally necessary condition that the conditions of underground work are made such as to reduce to a minimum the occupational risks to health and life. In the meantime, it would be well, in order to obtain data for the deliberate consideration of this serious question, to make tuberculosis in underground workers a notifiable disease.

Gold mining in this country is admittedly an unhealthy occupation; it has been proved that six to nine years' work, and sometimes a considerably shorter period, will inevitably impair or exhaust the working efficiency of a rock-drill miner. Of 47 fatal cases of lung disease among rock-drill miners who had worked in the Transvaal alone, Dr. Haldane and his colleagues found that the average period spent in rock-drill work was 4.7 years. And, in remembering the white miner, we must never forget the much larger number of sufferers amongst the native workers.

But are we to be content to sit down before this situation and look at it? We have looked at it long enough and it does not improve in the looking. Rather must we set to work as a community to alter it. And while it rests with the Government and the mining companies to provide adequate ventilation, adequate means of dust prevention, adequate sanitation, adequate change houses and quarters, and a judicious arrangement of working hours, a very great deal rests with the miner himself. Of some matters relating to the former aspect of the question we shall speak presently; on the latter, the private aspect affecting the individual miner, we wish to say something now.

In the matter of the incidence of lung disease amongst miners the initial physique of the man counts for very much. We always, although not as a rule with any marked success, seek to dissuade any man from becoming a miner whose chest development is poor. It is very close to the truth to say that, so far as occupational lung disease is concerned, the chest expansion of a man is the index of the length of his life as a miner. And further the condition of the chest can be improved and maintained by suitable chest exercises, which stimulate circulation in and excretion from the lungs. We have found the adoption of this treatment to produce marked amelioration even in established cases of miners' phthisis. Light dumb bells, Indian clubs, Sandow's developer, even simple breathing exercises, or a short sprint after the shift is over, are all or any of them useful in this respect. For, apart from infection, miners' phthisis is really mainly a mechanical disability, and it is of the utmost importance to prevent this disability from developing by maintaining the highest functional and excretory activity of the lungs.

The avoidance of risk of chills is another important point, in regard to which the regular use of change houses is all important. The West Australian Commission lay down most detailed provisions regarding the construction and the use of change houses, of which we most cordially approve. In these it is also provided that no man should go to his room in his working clothes. These must be left in the drying-house in his particular locker. The working clothes must be changed at least once a week, if they are left in the lockers over the week end they are to be confiscated and destroyed. The object aimed at is to prevent the living rooms of the men being rendered unclean and unhealthy by the presence of wet, dirty and perhaps faecally contaminated working clothes.

Another point is the individual's responsibility and duty regarding mine sanitation. Where adequate sanitary conveniences are provided, no white man should permit himself, or, so far as he can prevent it, the colored laborers under his control, to foul the underground workings with faecal deposits.

And, lastly, if dust preventives are provided, it is for the miners to use them.

Of course, whatever devices are recommended, it is certain that the men will object to use them. This experience is universal. But, should it be made legally compulsory, as it is now by the new regulations regarding dust prevention, to use some means of allaying dust by water, and the compulsion enforced by supervision and penalty, it would, we fancy, be remarkable how soon the traditional inertia of the miners in a matter so vitally affecting their own health would be overcome, when they really saw that the security of their occupation and of their pockets was involved in addition to the security of their health. And when we remember that not merely the health of the white miners is concerned, but that the health of the mass of our army of unskilled workers is also directly involved, there should be no hesitation in enforcing the use of these preventive measures.

And here we may say a word on the use of respirators. We have never regarded these as anything other than as a second, and unreliable, line of defence. The first consideration is to prevent the formation of dust and noxious fumes, or to remove them when formed. To rely solely on preventing the inhalation of dust is to occupy a weak and secondary defensive position. And to hammer again on the old nail: Respirators do not help the native. Nevertheless, respirators intelligently employed are useful for the specific purpose of preventing the inhalation of dust, and for all engaged in rock-drill work their use, when there is exposure to a very dusty atmosphere, is certainly advisable until better preventives are generally adopted. No doubt, they are a trouble to use and to keep clean, they are apt to get sat on in the skip, their valves get out of order; they get dirty, they are uncomfortable and hot; you can't smoke with them on or talk. But, in spite of all these inconveniences, they have been used to advantage by those who take them seriously and use them properly. Probably the light aluminum respirators are the best on the market. If they are going to be used, pin down the valve or it will get jammed half open in time, and replace the cotton wool with two layers of flannel cut to shape, the outer layer being removed at each shift.

But respirators are only tolerable to those whose breathing capacity is comparatively unimpaired, those who are already "short of breath" may not be able to bear the slight added disability they occasion. Their use, therefore, cannot be made compulsory.

III.

Dust and infective processes, as we have said, are two of the three factors mainly concerned in producing the high respiratory mortality amongst underground workers. The third is the vitiation of the general body of mine air by gaseous impurities. This vitiation may arise from several sources. In many mining areas abroad, chemical changes in the rock account for a large percentage of the total of carbon dioxide present. In Cornish mines, for example, Dr. Haldane and his colleagues found that the carbon dioxide in the mine air was almost entirely due to the slow oxidation of minerals and timber. On the Rand this is not the case, owing to the general absence of carbonates from the rock, and this source of contamination of the underground air is, under local conditions, practically negligible. Analyses have shown that the air in dead ends, where no work has been done for considerable periods, may show little excess of carbon dioxide over the outside air. The main sources of vitiation are, therefore, the respiration of the white and colored workers, the combustion of candles, and the gases produced by explosives.

One other alleged source of contamination we may dismiss as in general unimportant. In the Report of the Transvaal Miners' Phthisis Commission, a series of eleven analyses of "Air supplied by the Compressor" was published. In nine of these carbon monoxide was either absent or present only in small traces. But in two it was stated to be present in quantities which would render it quite impossible to carry on work, and since the local ventilation of many working places in the mines is dependent to a large extent on the exhaust from the rock-drills, the indictment against the use of compressor air was a grave one. Elsewhere these results were severely criticised. Dr. Haldane, in Cornwall, found that the compressor air was free from appreciable quantities of CO, and Mr. Mann, in the analyses published in the Western Australian Commission's Report, makes the same statement.

Dr. Moir, indeed, has recently stated his belief that these particular samples cannot really be taken as representative. Not being responsible for the taking of the samples, he was not responsible for the conclusions to which the analytical results appeared to point. That firing may occur in compressors, especially if oils of too low a flash point are used for lubrication, is, of course, undoubted, and that this has been the cause of fatal accidents is well known. Quite recently, at the end of February of this year, a native was fatally "gassed" on one of the mines of the Rand through the inhalation of gases, due to an explosion in the compressor cylinder. It appears that this was the third occasion within six years that a similar occurrence had taken place with this particular compressor. On the two previous occasions there had been no loss of life. In both of these the character of the oil had been suspected. In this last instance, however, the explosion was found to be due to the fact that a leakage had taken place in the air delivery valve, which allowed communication between the high pressure discharged air chamber and the cylinder, the high pressure air being thus allowed to return to the cylinder for re-compression. The result was that the temperature was at once greatly increased, probably to something in the neighborhood of 630 deg. F., and the oil in the cylinder and the receiver was vaporized and ignited. Underground it was noticed at once, at practically all the machines, that gas was escaping, and the men left the working places immediately. No fatality, indeed, would have occurred if one native had not characteristically gone back to fetch his coat from near the face of a drive. He was overcome, and although rescued alive, died within an hour afterwards. This accident was due to a mechanical defect, the displacement of a set pin in the high pressure air delivery valve. Similar leakages are a well known cause of accidents of this nature. Apart from occasional occurrences of this sort, the use of oils of a high flash point as lubricants, frequent cleaning, and the provision that the intake should be from the outside air, should suffice to prevent any general danger of vitiation of the underground atmosphere by compressor air. To avoid offensiveness from foul water stagnating in the pipes, water traps should be provided, which shall automatically blow themselves off when full of water.

This alleged source of vitiation being excluded, we are left, as we said, with the impurities due to respiration, to combustion of candles, and to explosives, as the main factors.

The six analyses published by the Miners' Phthisis Commission of "Normal mine air under ordinary working conditions" were certainly strangely labelled. All the samples taken were in "bad places," and even the average of carbon monoxide stated to be present, namely, 0.13 per cent., was so high as to be immediately dangerous to any worker who might be exposed to it. Such a quantity would produce symptoms of poisoning in half an hour or more. If this were a usual composition of the air, even in dead ends, serious gassing would inevitably be very much more common than it is. One was forced to the conclusion either that the estimates of carbon monoxide in these samples were incorrect, which we hesitate to assert, or that the samples were very far from being representative, on which point we have no doubt at all. One may be pardoned, therefore, for setting them aside as indicative of the composition of mine air in ordinary working places.

More recently Dr. Moir has provided us with an admirable series of analyses representative of the composition of mine air. They refer to one mine only, one of the deep level mines of the central group.

Dr. Moir's results are extremely interesting as an illustration of the practical working of natural ventilation in a deep level mine. There are two shafts, one acting as downcast, the other as upcast. Four levels of the mine had been developed, and in three of these stoping was fairly well advanced. Both shafts had been sunk below the fourth level, and some driving had been done from them, but stoping had not been commenced.

The total quantity of air supplied had an average of 75 cub. ft. per man per minute, but it varied between the wide limits of from 35 to 50 cub. ft. in summer, to as much as 140 cub. ft. in winter. Further, it was badly distributed, the main reef workings were well ventilated, considerable portions of the south reef workings were also satisfactory, others were not so either as to quantity or quality of air. The CO_2 rose from 0.35 per 1,000 in the downcast shaft to 1.0 per 1,000 in the upcast, but locally where the air current was poor it rose to 2.0 or even in one instance 4.0 parts per 1,000.

Two sets of observations are of particular interest. First.—Two analyses of the air close to the downcast shaft at the fifth and sixth levels, below the portion of the mine, which had been opened up, gave respectively

CO_2 1.79 per 1,000 CO 0.13 per 1,000
CO_2 1.39 " CO 0.22 "

This vitiation was due to the previous day's blasting, and it goes to show the unsatisfactory nature of ventilation under these circumstances, when only compressed air is relied on. There were about five men and two machine drills in each of the places.

Second.—An analysis of the return air of the mine, on a level, in a locality where a shift was working an hour after blasting, gave

CO_2 4.0 per 1,000 CO 0.38 per 1,000,

again pointing strongly to the necessity in these conditions of removing noxious fumes by mechanical ventilation before work is resumed. In this portion of the mine the air supply was insufficient, and a specially large quantity of explosives was employed.

Determinations were also made of the temperature and humidity in the shafts and workings. The air of the upcast shaft had a constant humidity of 100 per cent., and a practically constant temperature all the year round of 69.6 deg. F. The air of the workings was similarly almost constant in these respects, humidity being always over 95 per cent., and the temperature in open places practically constant at 69 deg. This was at a depth of 1,200 ft. In the downcast shaft, temperature and humidity varied, naturally, with season and state of weather, but the average humidity at the bottom of the shaft was 97 per cent. in an extended series of observations. The temperature ranged from 54 deg. F to 67 deg. F., according to season.

These results show very clearly the risks of reliance on what one may call haphazard natural ventilation—variable supply of air, unequal distribution, good ventilation in parts of the mine, a considerable degree of local vitiation in other parts. The exhaust from the rock-drills during working, and the use of compressed air from the mains to blow out the smoke after blasting, are the only supplementary factors commonly operative, and while the exhaust from the drills is usually sufficient to keep the air in their vicinity fairly good, it may be quite inadequate to secure the general purity of the air further back. Even where the drills are running there may be places where the condition of the air in their immediate neighborhood is very far from perfect.

Extended detailed analyses of this sort are very necessary to enable us to arrive at a satisfactory knowledge of the actual condition of the underground air in the mines of the Rand, and at a satisfactory judgment as to how far, and in what way, natural ventilation, particularly in deep level mines, should be supplemented by mechanical means. Probably the condition of this mine is fairly representative of that of many others, although we anticipate that the ventilation of the outcrop mines will be found to be, on the whole, satisfactory. The Government Mining Engineer is at present having a systematic series of quantitative determinations made in a considerable number of the mines, with a view to obtaining the extended data necessary. We have already stated our opinion that it is very desirable to supplement the present method of ventilation of drives, rises and winzes, by mechanical means, such as the water blast and ventilating pipes fitted with a reversible air jet, measures which should go a good way to meet the special difficulties of development. To adhere solely to a standard quantity of air supply is clearly inadequate if the proper distribution of that supply is not secured. For this we must supplement the standard minimum datum of quantity with a standard minimum datum of quality, which should apply to all the parts of a mine where work is being actually carried on.

We cannot, perhaps, do better than quote here the specific conditions laid down in the Western Australian Commission's Report to define what is pure air.

"The air in any part of a mine where men are working or passing shall be deemed to be pure air, and in a fit state for working and passing therein if

(1) The total quantity of carbon dioxide present does not exceed .15 per cent. of the air by volume; but at any point where firing has taken place such test shall not be taken until at least half-an-hour has elapsed since the firing, unless the men have returned to work; and

(2) The temperature does not exceed 85 deg. F.; but, nevertheless, a higher temperature may be allowed by the Minister on the recommendation of the Mines Regulation Board in cases where it may be shown to be impracticable to maintain a lower temperature; and

(3) The percentage of humidity does not exceed the amounts set out for the relative dry bulb thermometer readings in the table previously quoted (this is the standard laid down in the Cotton Cloth Factories Act, 1889); and

(4) That the temperature at the place where the test is taken is not more than 5 deg. F. above that of the air in the principal intake of air into the main level from which the said place derives its supply; and

(5) That there is a perceptible current of air passing the place tested sufficient to distinctly deflect the flame of a candle, but such test shall not be taken within 10 ft. from the face of a drive or crosscut, nor from the top of a rise or bottom of a shaft or winze, nor when rock-drills are working so close to the testing point as to cause agitation of the air.

The air shall be deemed inadequate and unfit for working or passing therein, if any one of these requirements be not complied with."

Adequate ventilation is the first "safety measure" in mining; it means efficient work and efficient health; inadequate ventilation just as certainly means inefficient work and impaired health. And the analyses we have quoted certainly show that, quite apart from dust, amounts of carbon dioxide and carbon monoxide may be present locally in the air of working places, not sufficient, perhaps to cause acute symptoms, but sufficient, if repeatedly inhaled, to deteriorate the health of the workers. And, in our experience, clinical observation confirms this view. We agree with Mr. Heymann in the opinion, which Dr. Black expresses in the Western Australian Commission's Report, "that chronic carbon monoxide poisoning is probably much more common than is generally supposed." As a matter of fact, it not infrequently happens, that a miner tells one that, when he was working in a rise or an ill-ventilated drive continually for three or six months, he felt during that time he was out of sorts, that he was steadily getting weaker, less able to do his work, more short of breath, suffering also, perhaps, from dyspepsia, until, finally, he stopped his work, or went to another part of the mine. Then he will tell one he began to get better again. Such cases as these are not uncommon, and we have little doubt that in them we may have what we may call a sub-acute or chronic carbon monoxide poisoning of a degree sufficient to cause symptoms of itself and certain to aggravate any pre-existing silicosis. It may be, indeed, that account must be taken of this factor in explaining why miners' phthisis is more fatal here than in other mining centres. It is quite likely that some and even much of the anaemia from which miners suffer is traceable to this cause, and the general anaemia and lowered vitality also necessarily imply a local lowering of vitality on the part of the lung, rendering it more susceptible to the action of irritants and the invasion of infective processes.

There are three reasons then why miners' phthisis is apparently more prevalent and more fatal on the Rand than in other mining communities. First, that the rock is hard, and the mines are relatively dry. Second, that the number of rock-drills used is proportionately great. Third, that the quantity of explosives used is also proportionately large.

And there are two main preventives—water for the dust, ventilation for the gases.

The Western Australian Commission do not advise the use of water for the prevention of dust, for the specific reason that the increase of water in the mines would increase the risk of the introduction and spread of ankylostomiasis. They would prefer some method of dust extraction, although they admit that no satisfactory method of doing this has yet been devised.

The same risk may, perhaps, be held to exist in our own mines. During the last few years cases of ankylostomiasis, and even occasional deaths from the disease, have been reported as occurring amongst the native workers. We have not as yet, however, seen any cases clinically pointing to the existence of "miners' worm" in whites, although at Kimberley the disease is not uncommon. Nevertheless, ankylostomiasis is, undoubtedly, liable to occur amongst the natives, and particularly amongst those from the tropical coast districts. It should, therefore, always be looked for, and when found it should be dealt with, in the detention compound and on the mines, and no native who is known to suffer from the disease should be allowed to go underground without previous thorough treatment. Ankylostomiasis is already a notifiable disease. Whether the general acidity of the underground water, as has been suggested, has hitherto been a safeguard against the dissemination of the worm underground or not, the increased use of water might, by making the working places locally more muddy, tend to add to the risk of its spread. It is in warm faecally contaminated mud that the ova and larvae of the worm develop.

The question is which is the greater risk—dust or the worm. Unquestionably dust. Ankylostomiasis when recognized, and it should always be looked for, is infinitely more amenable to treatment than are the lung diseases of miners. Nor do we consider, judging from the experience of the past few years, when the worm has undoubtedly been present amongst certain tribes of natives, that the future danger to the industry from this source is likely to be serious, provided reasonable precautions are taken. Nevertheless, in spite of recent great improvements, we doubt whether underground sanitation is everywhere regarded with quite the seriousness which the circumstances warrant. Its supervision should be held to be the particular duty of an adequate staff of special inspectors. The native, of course, does not regard it as serious at all, and as he is apt to act in that belief, he is the main source of danger. In all cases where the compounds are at a distance from the shaft heads, additional latrines should be provided within a reasonable distance of the latter, and in any case pressure should be put upon the boys to make use of the latrines before going underground. Further, the use of underground water for drinking purposes should be prohibited. The native and colored workers should be supplied with water bottles which should be filled from a pure source.

Dr. Haldane and his colleagues conclude their "Report on the Health of Cornish Miners" with these remarkable words:—

"We venture to express our conviction that there is no reason why work underground, in whatever kind of mines, should not be a perfectly healthy employment; the work itself is thoroughly wholesome both to body and mind, and the special dangers, whether to health or to life associated with different varieties of mining are such as if recognized and faced can be avoided, provided that both employers and employed will co-operate in bringing this end about."

To many these words may appear to convey a mere counsel of perfection. But we are not justified in treating them so until we are sure that everything practicable has been done both by employers and employed to realize them as far as may be in practice. The mines of the Rand have gained an unenviable reputation with regard to the mortality and sickness which occur amongst both the white and the native workers. Everyone must recognize the many economic difficulties which the mining industry has to face. Everyone must recognize that climatic more than occupational influences are largely responsible for the high death-rate amongst our native workers, and that very much has been done within the past few years to make life and work upon the mines both more attractive and more healthy. Knowing this, we can afford to ignore the ridiculous statements which have been so freely made in England regarding the treatment of the workers by those responsible for the direction of the mines. But at the same time it is our conviction that more is needed. The adoption of the measures we have outlined would no doubt lead at the outset to increased expenditure and higher costs, but we are convinced that it would be an expenditure which would yield a rapid return by directly decreasing the wastage which now occurs in health and life—a wastage which in view of the restricted nature of our supply of unskilled labor in South Africa constitutes a most serious economic drain.

THE EARTH'S TEMPERATURE.*

(By Hugh F. Marriott.)

The country in the immediate vicinity of the Main Reef series consists chiefly of evenly-deposited sandstones and shales which have been faulted and intersected by dykes only to a very moderate extent, and have not been subjected to any great disturbing earth movements. The country rock does not contain constituents to any appreciable extent which are liable to decomposition on exposure to air and water. Iron pyrites is present only in a proportionately small degree, and, so far as yet noted, occurs only in isolated crystals. These facts render the locality suitable for the further establishment of the theory of regular and systematic increase of temperature in direct proportion to the depth from the surface.

The Witwatersrand area possesses peculiar advantages for the estimation of deep-level temperatures, having within its more central limits an extensively-worked closely-allied series of outcrop mines, flanked by a deep level row of mine workings, which in their turn are outlain by still deeper shafts and mine works, and by bore-holes which penetrate the strata to great depths.

The various mines and bore-holes in which the temperature observations were taken, are grouped together within an area of eleven miles along the strike of the country by one and a half miles to the dip of the reef deposit. The positions of the various

*Read before the Institution of Mining and Metallurgy, March, 1906.

places noted are easily ascertainable in any of the published maps of the district and need not be further detailed here.

The depths at which the observations were taken are recorded hereunder. They are as follows:—

Name.	Mine or Bore-hole.	Range of Observations, in Feet, Vertically Below the Surface.
Robinson G.M. Co.	Mine	Between 497 and 784 ft.
Crown Reef G.M.Co.	Mine	Between 547 and 914 ft.
Geldenhuis Deep	Mine	Between 500 and 1000 ft.
Ferreira G.M.Co.	Mine	Between 500 and 1142 ft.
Ferreira Deep	Mine	At 1158 and 1175 ft.
City & Suburban G.M. Co.	Mine	Between 495 and 1201 ft.
Jumpers Deep	Mine	Between 848 and 1235 ft.
Village M.R.G.M.Co.	Mine	Between 518 and 1242 ft.
Crown Deep	Mine	Between 590 and 1253 ft.
Durban Deep	Mine	Between 500 and 1420 ft.
Nourse Deep	Mine	Between 530 and 1500 ft.
Simmer East	Mine	At 1700 and 1800 ft.
Robinson Deep	Mine	Between 500 and 2400 ft.
Bezuidenville	Bore-hole	Between 1000 and 2930 ft.
Turf Mines	Bore-hole	At 3400 ft.
Simmer West	Mine and Bore-hole	Between 3358 and 3473 ft.
Jupiter G.M. Co.	Mine and Bore-hole	Between 3906 and 3916 ft.

The following mines also were included **in** the observations of relative air and rock temperatures on the fields:—Geldenhuis Deep, Ferreira Deep, Langlaagte Deep, French Rand, Durban Roodeport, Robinson Central Deep, Jumpers Deep.

The thermometers used were made in each case to suit the particular class of work required, and included the following designs:—

1. Slow-registering maximum thermometers, in which the mercury index is separated from the main column and is left in the highest registered position when the column recedes on cooling. The thermometer proper is encased in an outer glass tube containing alcohol in liquid and vapor form, and it is thus effectually protected from any exterior changes of pressure, and is only slowly susceptible to changes of temperature.

2. Quick-acting maximum thermometers with a separate mercury index. Except as regards the detached index, these were made on the pattern of the ordinary clinical thermometer, and are extremely rapid in their recording properties.

3. Quick-acting themometers of design exactly similar to the ordinary clinical thermometer, in which the mercury column passes from the bulb into the stem through a restricted neck, and remains in position as an index of the maximum temperature recorded.

This last type of instrument has proved itself universally reliable throughout the various classes of experiments, and is the best and handiest design for work of this description.

Several other types of thermometers were made for this work, and were tested for efficiency under the varying conditions. One of these, a variation of Walferdin's thermometer, is interesting from the theoretical point of view. In this instrument the bulb and stem were fully charged with mercury at the commencement of the experiment, and on being heated the mercury flowed out through the nozzle in the top of the stem into the bulb or cup, which was so designed that, when used in any position except that approaching the horizontal, the discharged mercury was imprisoned in the cup and could not return down the stem on cooling. The method of reading the record obtained was by re-heating the thermometer in an air or water bath, in conjunction with a standard thermometer, until the mercury again reached the overflow point. The temperature recorded by the standard thermometer was then noted. Another method was to have the stem graduated in an inverted order of degrees, which were calibrated at a given standard temperature. The thermometer was thus placed in a bath at the standard temperature, and the previously-recorded temperature was then read directly off the top of the mercury column standing in the stem.

For use in mine work the design mentioned as No. 1 was encased in a copper tube perforated at both ends to allow the free passage of water. The remaining designs were used enclosed in water and air-tight iron tubes, which were lined with wood to render the thermometers less susceptible to temporary changes of temperature.

In making experiments down the mines, wherever possible, the system of preparing the ground for observation was as follows:—A spot was chosen in a drive, cross-cut, or pump-station as nearly at the required depth from the surface as convenient, and as far removed from the main air-way as possible. A 5-ft. hand-drill hole was then put into the wall near the floor, inclined downwards at an angle of about 30° from the horizontal. This hole was then filled with water and the mouth plugged with clay, after which it was left untouched for at least twenty-four hours. This procedure ensured the obtaining of the true rock temperature at the point of observation.

Wherever feasible, two thermometers of different makes were placed in the bottom of each hole thus prepared, and in some cases another thermometer was placed at the mouth of the hole as a check on the main results. The hole was again sealed up with clay and the instruments left in position for at least half-an-hour. The thermometers were then withdrawn, the readings taken, and the variation, if any, of the upper instrument from the lower was noted.

At intervals during the complete series of experiments, the thermometers used were all checked at different temperatures within the range required against a standard thermometer, and the corrections were noted and applied to the readings. In every case the extreme variations of the air temperatures at the time and point of observation were recorded by a maximum and minimum thermometer with iron indices, and these readings proved valuable in checking the reliable results obtained, and eliminating readings of doubtful veracity.

For bore-hole work various types of thermometers were tried; but the clinical type with the completely cut-off column described under No. 3 was finally exclusively adopted as giving the only consistently reliable results.

These thermometers were enclosed in a watertight case in a set of four, two being placed upright and two inverted. The case was then lowered, by means of a wire passing over the measuring drum, down the hole to the depth at which records were required.

The bore-holes experimented upon were continued to great depths and were invariably almost full of water, and thus enormous external pressure had to be contended against as it was essential that the thermometer readings should not be complicated by varying pressures during the experiments. The type of case specially designed for this work has proved so successful in practice that it is worthy of a short description.

A solid steel cylinder, of diameter suitable to the requirements of the bore-hole, is drilled longitudinally in four blind holes, each just large enough to take a thermometer of the size required. These four holes open into an upper circular chamber which is closed by means of a screw plug containing a square keyway sunk in its head. The wall of this chamber is made as thin as possible, consistently with having sufficient strength to carry the outer cap, which is of the same diameter as the cylinder and is screwed down over the chamber containing the plug. The top of the outer cap and the bottom of the cylinder are each cut to take a hexagonal spanner.

An absolute lock against the transference of external pressure to the thermometer chambers is produced as follows: any leakage through the joint of the outer cap must pass up along the outside of the thin chamber wall and into the hollow keyway of the plug. This pressure acting primarily on the outside of the chamber wall causes the screw plug joint to become tighter. Any access of pressure within the keyway of the screw plug also serves to further tighten the joints of both sides of the chamber wall, and this action is intensified indefinitely with increase of pressure. The tightening effect is also assisted by expansion due to the rise of temperature encountered.

In practice, the total leakage has never amounted to more than a single drop of water introduced into the keyway, and the plug and cap are never more tightly screwed up than can be easily accomplished by a small hand spanner.

In case any extreme jarring were to falsify the results of the thermometers, the two upright instruments would give lower records than those in an inverted position, and the error would be thus immediately discovered.

To ensure the thermometers being introduced at a temperature lower than that to be recorded, the cases are prepared for the reception of the cooled thermometers by being placed in a freezing mixture such as ice and salt. Where light transport is a consideration, a convenient method is to surround the cases with cotton waste, and, having saturated this with ether, to place it in a current of air. Care must, however, be taken that the thermometers themselves when lowered are free from any continuous disturbing influence of this nature.

Details of the readings taken in the Mines, are as follows:*—

Robinson, G. M. Co.—At 497 ft. vertical, the reading was taken in a 5 ft. machine hole which was located in sandstone 10 ft. from the wall of a dyke. It gave 68.5°.

At 784 ft. vertical, the reading was taken in a heading the air in which registered over 70° of temperature; the result was 68.25°.

Crown Reef Gold Mining Co.—At 574 ft. vertical the reading yas taken in a hole in sandstone 184 ft. distant from a large dyke; the result was 67°.

At 914 ft. vertical the reading was taken in sandstone in a hole in the cross-cut which connects this mine with the Crown Deep, and the rock here has been subjected to a continual draught of cold air; the result was 65.5°, and the water in the launder coming down from the higher levels was 67°.

Geldenhuis Deep.—At 500 ft. vertical the reading was taken in sandstone in a dry 5 ft. hole sunk in the footwall of a stope lately opened; the result was 68°.

At 1000 ft. vertical in No. 1 Shaft the reading was taken in sandstone in a 5 ft. hole, one thermometer being in water and the other in air; the result was 67.75°, the air temperature here being 70°.

At 1000 ft. vertical in No. 2 Shaft the reading was taken in sandstone in a wet hole and gave a result of 70°.

Ferreira Gold Mining Co.—At 500 ft. vertical the reading was taken in a 5 ft. hole in the sandstone and gave a very reliable result of 67.5°.

At 1000 ft. vertical, the reading was taken in a 5 ft. hole sunk in the sandstone footwall of the shaft, down which water was continually flowing; the result was 69.5°.

At 1142 ft. vertical, a similarly located hole gave 71°.

Ferreira Deep.—At 1175 ft. vertical, a 5 ft. hole in sandstone in the cross-cut in No. 1 Shaft gave 62.9°, the air temperature during the experiment fluctuating between 74° and 81°.

At 1158 ft. vertical, in No. 2 Shaft, a 5 ft. hole in sandstone gave 71°, thus checking very nearly the results obtained in the bottom of the Ferreira Mine only a short distance away from this point.

City and Suburban Gold Mining Co.—At 495 ft. vertical, a 5 ft. hole located in the sandstone, in a situation at the side of the shaft, gave 58°.

At 1021 ft. vertical, a dry 5 ft. hole gave 67.5°, and at the bottom of the shaft 1201 ft. vertical, a hole placed in the reef in a locality subject to frequent blasting operations gave 70.5°.

Jumpers Deep.—At 878 ft. vertical, in No. 1 shaft, in sandstone, a hole in a heading gave 69°, the surrounding air registering 68°.

At 848 ft. vertical in No. 2 shaft the result was 68°.

At 1076 ft. vertical, a hole placed in the wall of a dyke gave 68.5°; at 1148 ft. vertical, a hole also in a dyke wall gave 69°, and at 1235 ft. vertical, the reading was 69.5° in sandstone.

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*[Note.—All readings are given in degrees Fahrenheit.]

ALONG THE G.T.P.
Moving "house" on the height of land.

ALONG THE G.T.P.
William Laloche, a Tête de Boule Indian, and his family.

Village Main Reef Gold Mining Co.—At 518 ft. vertical, a 4 ft. hole put in the side of a level in the older workings of the mine gave 65°.

Another hole, 2 ft. deep only, gave 66° and the surrounding air registered 68°.

At 1026 ft. vertical, a 4 ft. hole gave 63°, and at 1242 ft. vertical, 2 holes each 4 ft. in depth, one wet and the other dry, gave 65.5°, the air temperature here being 66.5°, and the water standing in the level 64.5°.

Crown Deep.—At 590 ft. vertical, a hole in the sandstone in the shaft near a fault gave 67.°.

At 1026 ft. vertical, a hole in the side of a stope gave 70°.

At 1253 ft. vertical, a hole in the side of a drive gave 70°.

Durban Roodepoort Deep.—At 500 ft. in the side of the vertical shaft the reading was 56°.

At 1000 ft. vertical in the same shaft the reading was 61.6°.

At 1420 ft. vertical, in the incline of the same shaft, the reading was 65°, the air here being over 70°.

Nourse Deep.—At 530 ft. vertical, a hole in the shaft gave 68°.

At 1000 ft. vertical, a hole in a cross-cut gave 70°.

At 1500 ft. vertical, a hole in the incline shaft gave 73°.

All these holes were located near dykes and gave reliable results as to the temperature of the rock under these conditions.

Simmer East.—At 1700 ft. vertical a long machine drill hole gave 72.5°, the surrounding air registering the same temperature, and at 1800 ft. vertical the reading was 72.5°.

These holes were open and not previously prepared for the experiments; their results, though corroborative, cannot be taken as primary evidence.

Robinson Deep.—This mine was subjected to a series of exhaustive tests. A first series of shallow holes was taken in pump stations down No. 1 shaft.

500 ft.	vertical	in sandstone	gave	62.5°.
1060 ft.	"	in dyke	"	66.5°.
1500 ft.	"	in dyke	"	63° and 67.5°.
1950 ft.	"	in sandstone	"	66.25°, the air here being 63.5°.

At 2400 ft. vertical a hole placed near the shaft in the main air-way of the mine gave 67°, the air here being 66.25°, the water in a dam 67.5°, and the water flowing into the same from the shaft being 66.5°.

Second Series of 5 ft. Holes.

500 ft.	vertical	in sandstone	gave	57.5°	(Extra checks taken)
		air temperature	"	56.0°	(do.)
1060 ft.	"	in dyke	"	60.25°	
		air temperature	"	56.0°	
1500 ft.	"	in dyke	"	62.5°	
1950 ft.	"	in sandstone	"	68.0°	
2200 ft.	"	in sandstone	"	73.5°	(A very reliable reading)
		air temperature	"	76.0°	

2400 ft. " in a hole drilled in a hot stope drive, in which the air registered over 80°, the reading was 76.5°.

Bezuidenville Bore-hole.—Readings taken before closing the hole at 2930 ft.

At 1000 ft. vertical	....	69.0°
1500 "	....	71.75°
2000 "	....	75.0°
2500 "	....	75.5°
2925 "	....	78.0°

Another reading taken after the hole had become blocked up gave at this last point 75° only.

Howard Shaft, Simmer West.—At the 3358 ft. level in the cross-cut north, at a distance of 205 ft. from the shaft, a drill hole was put in on the west side of the cross-cut 6 ft. in length and inclined slightly downwards. The mean result of four readings and two observations gave for this depth a temperature of 80.4° F.

At the same level=3358 ft. deep, a bore-hole had been sunk in the floor of the cross-cut, at a distance of 90 ft. from the shaft, its dip being 55° north. The thermometers were lowered a distance of 140 ft. on the incline, or 115 ft. vertically below the level of the cross-cut, thus making a total depth from the surface of 3,473 ft. The mean result from the readings of four thermometers used for this observation gave for this depth a temperature of 81.5°F. This may be taken as a particularly reliable result, as the readings from the thermometers of various makes checked one another to within half a degree.

Catlin Shaft, Jupiter G. M. Co.—At the 3906 ft. level in the cross-cut north at a distance of 137 ft. from the shaft, a drill-hole was put in on the west side of the cross-cut 6 ft. in length and inclined slightly downward. The results obtained from the readings at this point gave for this depth a temperature of 82.4° F.

At the same level=3906 ft. deep, a bore-hole had been sunk in the floor of the cross-cut at a distance of 105 ft. from the shaft, its dip being 43° north. This hole was found to be blocked at a depth of 14 ft. on the incline, or 10 ft. vertically below the level. Readings were taken, therefore, at this depth=3916 ft. from surface, and the average result gave a temperature of 83.25° F.

This last experiment, however, cannot be considered as conclusive, owing to the water in the bore-hole having been in communication with that flowing along the level immediately previous to the time of making the experiment.

Turf Mines.—West Bore-hole.—Readings taken at the surveyed depth of 3400 ft., gave a temperature result of 80° F. These readings were consistent throughout, and were subjected to severe tests for accuracy. At the time they were made the bore-hole was unsurveyed, and the apparent result did not coincide with the already established mean line of temperature. The subsequent survey, however, enabled the reading to be allotted the correct position on the scale of depth, and this record, the final piece of evidence obtained from an isolated position in undisturbed country, constitutes a convincing corroboration of the general tenor of the now established mine results.

The results recorded at a depth of over 3,000 feet from the surface were obtained at a considerably later date than those upon which the line of mean temperature was first estimated. They were found to comform in a remarkable manner to the results of the previous work.

An inspection of a plotting of these borings shows many recorded points of divergence from the accepted mean line of temperature. These variations are attributable to several causes, some of which can be readily ascertained, while others are more obscure. For example, the Bezuidenville bore-hole reading at 2,000 feet is more than a degree higher than that indicated by the mean line; and the geological records show that the rock passed through at this point consists chiefly of dyke matter.

In several observations taken in the mines also, it has been noticed that a higher temperature of varying degree prevails in the vicinity of dykes and disturbed ground.

The marked deviation from the normal of the complete series of observations taken down the Robinson Deep shaft demonstrates very clearly the cooling effect of the air introduced by natural ventilation in the mines. At the 1,500 feet level, for instance, three readings taken in holes drilled in dyke within a few feet of the shaft give results 3½°, 8° and 8½° below the normal, and this difference was maintained in the readings taken in the upper stations of the shaft.

The position of the Durban Roodepoort Deep in the diagram is probably due to the fact that the readings were taken in the side of a very wet vertical shaft, in which the cooling effect would be more rapid than would be the case if air were the only conductor.

The City and Suburban records, and some of those of the Village Main Reef also, give remarkable instances of the rapid secondary cooling which has taken place. It is worthy of note that these two mines are situated in adjoining ground.

The records of the number of feet of depth for each degree Fahr. of rise in temperature, as observed in various deep bore-holes, are given in "Earth Temperatures" by E. Dunker, as follows:

	English Ft. per 1° F.
Neuffen Bore-hole	20.5
Rosebridge Mine	47.6
South Hetton Bore-hole	50.0
Preguy Bore-hole	53.4
Sperenberg Bore-hole	61.5
Kentish Town Bore-hole	64.0
Schladebach Bore-hole	72.3
Schladebach Bore-hole	65.0
Grenelle Bore-hole	75.75
St. Gotthard Tunnel	84.5
Adalbert Mine, Przibram	105.0
Bootle Waterworks, Liverpool	234.0

These records show that the proportionate increase of temperature at depth varies very greatly in different localities, but the details of the observations prove conclusively that the increase of temperature is in direct proportion to the depth.

It is upon this law that the following estimate of mean earth temperatures for the deeper levels of the Witwatersrand Gold Fields is based, and the mean rate of increase as deduced from the above detailed record is—

1° Fahr. for each 208 ft. increase in depth,
or
48° Fahr. increase per 100 ft. of depth.

Thus starting from the mean temperature of 1,000 feet depth = 68.75°, the following table is obtained:

Depth Ft.		Degrees Fahr.
1000	=	68.75
2000	=	73.55
3000	=	78.35
4000	=	83.15
5000	=	87.95
6000	=	92.75
7000	=	97.55
8000	=	102.35

The experiments have shown that the natural ventilation of the mines decreases the rock temperature in the vicinity of the workings from 5° to 10°F.

This action will tend to become more marked in the deeper levels opened up, where the contrast between the temperature of the entering air and that of the surrounding rock walls will be more accentuated.

The establishment of air communication between the deeper level mines and those adjoining them towards the outcrop will also tend to still further reduce the working temperature, as, unless special conditions intervene, the natural pull of the ventilation will cause all the deepest shafts to act as downcasts, and as such they will introduce the colder air directly in those portions of the mines where it will have the greatest cooling effect.

The heating effect of the decomposition of dyke matter in the locality has been shown to be so light as to be negligible, and it is not clear that the instances of increases of temperature noted are, as a body, due to the result of chemical action.

The whole evidence obtained goes to prove an extraordinary uniform and moderate rate of increase of temperature in depth at this interesting portion of the earth's surface. The practical deductions to be made therefrom are of special gratification to the miner, in that every change from the normal state, resulting from his work, will, where controlled alone by the laws of nature, take place invariably to his advantage.

POWDER TESTING.

A useful paper on the "Testing of Explosives" appeared in the *Mining Magazine* recently. It was written by Mr. J. B. Porter, who, it will be remembered read a paper before the Mining Section of the Canadian Society of Civil Engineers in November, 1905. An abstract of this paper follows:—

The testing of explosives for mining use is usually accomplished in the so-called lead bombs, namely, cylinders of cast lead originally designed by Trauzl. The lead cylinder is 8 in. in diameter and 8 in. high, with a hole 4-5 in. in diameter and 4 2-5 in. long cored axially from one end to just beyond the centre of the cylinder. The tests are carried out by placing a weighted quantity, usually 20 grams, of explosive in the cylinder, inserting a standard detonator with a fuse, tamping lightly with dry sand and firing. The enlargement of the hole is then measured and the strength of the explosive calculated by that means. The correction for the detonator can be made by firing a second identical cap alone in a second cylinder.

The author, in a paper read before the Mining Section of the Canadian Society of Civil Engineers, November 30th, 1905, describes some modifications which he introduced in order to obtain results more closely approximating the practical conditions. He states that the most serious fault with the Trauzl test is that the proportions are not those of an ordinary blast, as the hole is too short, the fuse is disproportionately large and the tamping is very ineffective. Therefore, a very considerable part of the explosion is wasted, and as this loss is greater for slow than for quick powders, the test is unfair to powders which require substantial tamping.

A few months ago, the author had occasion to compare a number of powders, and as he was convinced that the proportions of the Traulz cylinder could be changed with advantage he calculated from the theoretical considerations the shape of a lead cylinder in which shots could be fired without undue loss of force through the charging hole. It was undesirable to make the cylinders longer than necessary, as they are expensive and can be used but once, but it was also important to make them long enough to hold a reasonable amount of tamping and to confine the gases until the work was accomplished. He, therefore, decided after a number of experiments upon cylinders 125 mm. (5 in.) in diameter and 200 mm. (8 in.) in height. The bore hole was made 12 mm. (15-32 in.) in diameter and 135 mm. (5½ in.) in depth.

Cylinders of cast lead are often unequal in quality and therefore the cylinders were cut from a solid cylinder of compressed lead. When the cylinder was then cut into the required lengths and bored it was found to be perfectly homogeneous. Charges of various size were used, but 8 grams was found most satisfactory for high explosives. The experiments were made with detonators fired by electricity, as the use of a fuse with the Trauzl cylinders seemed always to lessen the efficiency of the tamping. The small wires leading to these caps were found to interfere scarcely at all with the tamping of dry sharp sand, which was run in on top of the charge and shaken down as compactly as possible. As the bore hole was yet much shorter than in practice the sand tamping was further compressed by placing a lead weight of about 100 lbs. on top of it. The cylinders were placed for firing upon an anvil weighing half a ton.

The author states that a large number of tests were made in these cylinders, and the results were most satisfactory. Duplicates, which with ordinary Traulz cylinders seldom agree within many per cent., were found to agree remarkably well with the new cylinders. Differences over one per cent. are stated to have been very rare, while in most instances the checks were so exact as to be practically identical. The cavities were measured by running in water from an accurate burette, correction having been made for the volume of the original bore hole and for the effect of the cap.

In the author's opinion the tests described above are still far from being identical in character with actual blasting operations, as lead yields slowly to rupture, whereas blasts in the rock always rupture the material and afford the gas an almost free means of escape. He believes, however, that tests made in cylinders proportioned as those he has described will be more fairly comparable with actual blasts than tests made in other apparatus. Probably the cylinders still give somewhat higher results for quick powders, such as dynamite, when compared with slow powders, such as common blasting gunpowder. This difficulty can, however, probably be largely corrected by further changes in the dimensions of the apparatus and by increasing the weight used to confine the tamping.

The most important thing, however, in the opinion of the author, which remains to be done, is to compare tests in the cylinders with the results of actual blasting operations on a large scale. For this purpose he wants to interest practising engineers in this matter so that they will keep careful records of the results obtained by the use of different makes and grades of powder, and will provide him with samples of the powder used so that he can make the tests in the lead cylinders. By cooperation of this kind it is probable that some definite comparable relation can be proved between practical blasting in different classes of rock under different conditions of work and the testing experiments on a small scale. It will then be possible to determine in advance the approximate working strength of different powders and to tell which one will be most suitable for any particular work to be done.

CORRESPONDENCE.

THE YUKON NOT DEAD.

956 Nicola Street,
Vancouver, B.C.
July 27th, 1906.

The Editor Canadian Mining Review:

Dear Sir,—

Your esteemed favor received.

My journey North was a successful one, and the Klondike and Yukon have a big future.

From personal observations I would judge that that country will be one of the greatest dredging fields in the world. Vast deposits of auriferous gravels exist, of low value, it is true, 15 cents to 20 cents per cubic yard, but which as facilities improve will be worked. The overburden of peat and moss which one hears so much about, is not such a serious obstacle as one would imagine, when water facilities are at hand and the bedrock has a decent grade.

I should judge 80 per cent. is water frozen.

The White River channel is another proposition which will be worked in the near future, whether by hydraulic method, or free milling process remains to be seen, but if the latter, then the power question crops up, and as wood fuel is too expensive, other means must be found, and which fortunately exist, in my opinion, on the Indian River, bordering the great Klondike District on the south. Coal croppings are there, and, I believe, with proper development, a coal basin will be proved of great importance, as electric power could be generated at the pit-mouth, and transmitted to the different operators around Dawson.

The northern country has great chances for capital well directed.

Yours very truly,

ARTHUR E. HEPBURN.

956 Nicola Street,
Vancouver, B.C.

We are in receipt of the Calendar of Dalhousie College and University of Halifax, N.S., for 1906-07. The Faculty of Engineering is conducted by Professors Ebenezer Mackay, Daniel Murray, Joseph Edmund Woodman, A. Stanley MacKenzie. The next term will begin Sept. 13th, the last day for receiving applications for the autumn preliminary examinations being August 16th.

CUSTODIANS OF GREAT WEALTH.

In the course of his presidential address, delivered before the Institution of Mining and Metallurgy at the last annual meeting, Mr. Arthur C. Claudet made the following remarks:—

"Everyone will agree that our special profession—that is all mining and metallurgy, apart from coal and iron—should have a strong and powerful institution to raise the standard of science and practice within our sphere of influence, and not only to protect and advance our own professional status and interests, but in every way in our power to further the wellbeing of the great industries we represent. As many of you are aware, those industries produce for the British Empire alone a sum of no less than £70,000,000 sterling per annum, to say nothing of the colossal extent to which British capital is employed in them.

"After two or three ineffectual attempts to found a society such as ours, this Institution came into existence in 1892, and I will quote the remarks that the late George Seymour, Assoc. R.S.M., our first and greatly esteemed President, made at the first general meeting, which was held in the Lecture Theatre of the old Royal School of Mines in Jermyn Street. Mr. Seymour said:

"'Whilst the members of other branches of mining and of practical science and applied science have, for many years past, had frequent opportunities of meeting and conferring together upon subjects of technical and mutual interest, it is, to say the least, curious that the metalliferous and metallurgical engineers of the greatest mining and commercial empire which the world has ever seen, should have taken no serious measures to found some central Institution, for the consideration of subjects of such common and absorbing interest.'"

"In concluding his address, he said:

"'I was anxious to impress upon you, and, through you, possibly upon others, the magnitude of those interests with which we are associated as mining and metallurgical engineers, which have extended beyond all historic times, and which now spread over almost every quarter of the globe. It is upon us, gentlemen, and upon our brethren abroad, that the custody and exploitation of these inexhaustible stores of mineral wealth der a good and faithful account of our stewardship. The founders of this Institution have been guided by the hope that the best and highest interests of the profession would be advanced by its efforts, and that in process of time, by adopting all that is good, and, so far as is possible, avoiding all that is unprofitable, it would become at once both a benefit and a safeguard to its members. Such I believe and hope will be the case.'"

NEW USE FOR TANTALUM.

The use of tantalum for the manufacture of writing pens, as a substitute for gold pens, is described in a British patent granted to Siemens & Halske, Berlin, Germany.

Steel pens have the advantage of great hardness and elasticity, but they do not resist the action of chemicals and in particular, of that of atmosphere and of ink. Gold pens, on the other hand, offer great resistance to chemical action, but their mechanical properties are relatively inferior. According to the present invention pens are made of metallic tantalum, a metal that is exceedingly resistant to chemical action and at the same time possesses a high degree of elasticity and hardness. On account of the great hardness of pens made in this metal they have also a much greater resistance to wear than steel.

The pens can be made either of pure metallic tantalum or of alloys thereof, with other metal, and the tantalum can also contain small quantities of other substances such as carbon, silicon, boron, serving to impart greater hardness thereto.

For the sake of economy, parts of the pens may be made of other materials, such as steel, and only the points or parts subject to wear or strain, be made of tantalum.

WATER-SPRAYED AIR.

A paper on the effect of water-sprayed or damped air in coal mines was prepared by Mr. James Ashworth, M.E., Chaddesden, Derby, England, and read before a general meeting of the North of England Institute of Mining and Mechanical Engineers at their last general meeting at Newcastle-on-Tyne.

The author propounds the following questions: (a) Shall we attempt by spraying, the impossible task of limiting a possible explosion? or (b) shall we give attention to the comfort and health of underground labor, and reduce spraying to a sanitary point?

Seeing that dust is constantly being produced during the transit of coal, there is always fine dust floating in the air mixed with moisture, much too small in quantity to produce the most explosive condition, and yet this dust is the most dangerous of any, and may be said to correspond with the dust which, having been left in pit for upwards of three-quarters of an hour after being thrown in, was exploded by Mr. H. Hall in more than one experiment. No percentage of moisture, under 5 per cent., can offer any restraint against the extension of a coal-dust explosion and it is not surprising, therefore, that in the disasters at Tylorstown, Universal and MacLaren collieries, the flame swept along the watered parts of the roads as if they were charged with gas. Experiments made in Germany, entirely support these facts, as it was there proved that water had no restraining influence on an explosion of coal-dust, unless the dust was so wet, that water could be squeezed out of it by the hand. It is useless, therefore, to depend on water-sprays for restraining the extension of an explosion after it has once been initiated.

Water-sprays are to some extent a sanitary requirement, but even from this standpoint can be overdone, and may become the means of extending the horrible disease known as ankylostomiasis. This is not a "bogey" to be lightly considered, but a serious matter: thus Dr. J. S. Haldane states that "it is evident that the spread of the disease may be entirely checked by preventing the pollution of mines by human excrement. Unless this is effected, as it certainly can be, the disease will probably spread gradually throughout the mines of England, wherever the temperature and moisture are favourable to the growth of the larvae. As damp and warm air is favourable to the propagation of ankylostomiasis, the writer would ask Dr. Haldane, or any other authority, what weight of moisture is permissible per cubic foot of air at certain temperatures, to enable colliers to work under the most favourable sanitary conditions. In 1899, there were 94 cases of ankylostomiasis reported in the Westphalian coal-field; in 1900, when water-spraying was made compulsory, the numbers increased; in 1901 there were 1,030 cases, up to October, 1902, 1,355 cases; and the increase continued, until at three collieries, 90 per cent. of the men were said to have been affected; but the disease was checked in 1903, and the percentage of men affected commenced to decrease. One means used for checking its extension was drier air, and, therefore, the Government Mining Board of Dortmund has sanctioned the temporary suspension of compulsory water-spraying. A Royal order in the Dortmund district also directs that, if the pit-water is not taken direct from the marl, it must not be used for spraying coal-dust.

The necessity for a full and dispassionate discussion of this subject is evidenced in other ways; thus it has been proved, in evidence given before the Royal Commission on coal supplies, that in the deep and hot collieries of this country, in Lancashire and Staffordshire, and in Scotland, water-spraying or other means of damping the air has had to be entirely abandoned, because warm damp air is so enervating that the colliers cannot do their work with any degree of comfort. Here, then, those who hold that watering of some sort is a necessary condition to ensure safety in dusty mines are confronted with a problem, for which at present there is no practical solution. Not only so, but owners, agents and managers of mines are placed in a serious position, for if an explosion occurs in a deep pit, where no watering is practised, H.M. inspectors of mines may, at once, assert that the colliery was not fitted with watering apparatus, and, therefore, that the management had been culpably negligent. And if the opposite extreme be taken, namely, of a colliery so situated that there is a great difficulty in keeping down the formation of ice on the main haulageways (No. 3 colliery of Tables I and II), and where watering is therefore an impossibility in winter, and even if it were possible, the grains of water that would bring it up to the point of saturation are so few (say 2.6), that although this mine has been described as a dusty and gaseous one, 2.6 grains of water would have to represent the factor of safety. Comparing this case with a deep pit, or say with the Universal colliery, where the air was carrying 4.4 grains of water at or near the pit-bottom, the time seems to have arrived when it ought to be authoritatively stated (1) what is the point of saturation to which air ought to be brought, and (2) how that saturation may be attained.

THE WINDY ARM DISTRICT.

A few months ago, Mr. R. G. McConnell, of the Geological Survey, wrote a short report on the Windy Arm district just north of the British Columbia boundary, where rich strikes of silver and copper are being worked. This season, Mr. D. D. Cairnes, of the same department, has been commisioned to survey the district, and his preliminary notes make interesting reading:

Mr. Cairnes says: "In the district north of the boundary, south of Carcross and between Windy Arm and Lake Bennett (an area of about 14 by 8 or 9 miles), over 260 claims are being held and a great deal of development is going on. The Conrad Consolidated Company own a great many of these properties and are pushing forward operations at seven of their camps. Machine drills are used at the Venus mine. The power is generated by a 50 horse-power gasoline engine. But, as there is enormous water-power on many of the creeks, piping etc., has arrived to establish water-power to replace gasoline engines. A double-cable tramway is in operation from the Montana mines to the beach at Conrad City, 3,400 feet below. Four other tramways, it is reported, are to be erected.

Conrad City was practically started this spring and is quite a little town; it is built on the west shore of Windy Arm and already boasts three hotels, three stores, a drug store, restaurant, etc.

The Anglo-American Consolidated Company have a number of promising-looking properties working to the south of Conrad, on Windy Arm. The leads are quartz, carrying high gold and silver values and can, in most cases, be traced for considerable distances. Though the leads are generally narrow, from a few inches up to two feet, they are high grade.

The mineralized rock of the Venus Mine is exceptionally wide, sometimes as much as 32 feet, and averaging, for considerable distances, over 20 feet; it can be traced over 3,000 feet. It is interbanded quartz and porphyrite and will average about $25 per ton.

A tunnel over 700 feet long has been run on the Montana lead, proving it to be from 2 to 4½ feet wide. About 14 inches will average $80 and the rest will go over $20 per ton. Wherever galena is present in these quartz veins, the returns are invariably high, on account of associated minerals—silver chloride, ruby silver, silver glance, stephanite, etc. Assays running into the hundreds and even thousands of dollars per ton are rather common from picked samples, rich stringers, etc. On the whole, the camp looks quite promising and, no doubt, will continue to go ahead rapidly.

Native copper is found in a number of places on the east side of Windy Arm, distributed through the rock, which is a slate and chert series, near contact with old peridotite intrusions. No leads have, as yet, been found, but scarcely any work or prospecting has been done.

Some rich copper ores carrying nickel and cobalt values, as yet rather low, have been, however, found on Marsh lake near here, and I am thinking of taking two or three days to look at the properties, as they are quite close, and are very interesting.

A recent free-gold strike has been made up the Wheaton river, about fifteen miles west of Robson. As this has just started, reports vary, but some very rich rock is coming down. This is in my district and I will see it soon.

All interested parties are very anxious to have more work done than I can possibly do this season, but I will work as late as possible and can cover a good-sized area.

WORK OF GEOLOGICAL SURVEY STAFF.

Communications received by the Directors from several of the field parties of the Geological Survey show that the work is everywhere progressing favorably.

From Dawson word has come that the work of estimating the volume and value of the gold-bearing bench gravels is well under way.

In British Columbia, Mr. LeRoy has finished the examination of the coast section from the international boundary to Burrard Inlet and is now continuing it in Howe Sound. He has traced out the rocks on the coast containing economic minerals and will carefully study the more important areas of Howe Sound.

Mr. Camsell in the Similkameen has finished the mapping of the Princeton coal basin, and has left to examine the Roche river, Kennedy and Copper Mountain camps along the South Similkameen from the international boundary northward.

Mr. Brock reports good progress in the detailed study and mapping of Rossland camp and sees no difficulty in completing the work before the end of the season. He has sent for analysis specimens of sands from Little Sheep Creek, which he suspects contain platinum, along with a considerable amount of gold.

No word has been received from Mr. Leach, in the Bulkley valley, nor from Mr. Dowling who is tracing northward the anthracite coal area on the eastern slopes of the mountains.

From the plains Prof. Macoun writes frequently and enthusiastically concerning the soil and crops of the country along the line of the Grand Trunk Pacific Railway to the west of Manitoba, while Mr. Chalmers has been employed giving advice as to the clays and the boring prospects in the same region.

The parties of Mr. McInnes and Mr. O'Sullivan who are exploring the country between the Saskatchewan river and Hudson Bay have not been heard from nor has word been received from Mr. Collins nor Mr. Wilson in Northern Ontario and Quebec.

Dr. Barlow, whose party is working in Quebec to the east of Cobalt, reports fair indications of minerals in the district, but owing to a thick covering of clay, discoveries are slow and difficult to make.

Mr. W. A. Johnston has nearly completed the work on the Peterborough map sheet and will soon move to the area of the Prince Edward map sheet which a few more surveys will complete.

The International Committee on the classification of the older rock formations is at work in Northern New

York and will transfer their field of investigation to Eastern Ontario towards the end of July. Dr. Barlow is official representative of the Survey on this commission.

In New Brunswick, Dr. Ellis is making considerable change in the classification of the rocks of the southern part of the province, and is also visiting the various mining centres with a view to the publication of a revised edition of the report on the minerals of New Brunswick.

Mr. Fletcher, after starting his party in the field, rendered assistance to Prof. Woodman who is closely investigating the iron resources of Nova Scotia for the Mines Branch of the Department of the Interior. Recently he has visited the lately opened seam of coal on the property of the Eastern Coal Company, Limited, at Maccan; the section in the face of the working gives ten feet of coal in a thickness of fifteen feet, the working coal being four feet thick, and apparently of good quality.

Mr. Faribault is busy revising work on the Nova Scotia goldfields with a view to writing a complete report on this important area during the coming winter.

LE ROI SHIPMENTS AND EXPENSES.

We have been favored by the Consolidated Mining and Smelting Company, Ltd., with the following statement:

1905	Shipments to Trail, tons.	Containing Gold, ozs.	Silver, ozs.	Copper, lbs.	Expenditure on Development	Estimated Profit, after deducting Cost of Mining, Smelting, Realization and Depreciation.
Sept.	.. 6,965 To N,port	3,079	3,050	172,850	$10,000	$17,000
	1,185 To Trail					
	8,150					
Oct.	... 2,150 To N,port	2,950	3,750	187,500	11,000	19,500
	8,075 To Trail					
	8,225					
Nov.	.. 8,000	2,550	4,350	187,600	9,000	17,000
Dec.	.. 6,925	2,772	5,300	205,700	8,000	32,500
1906.						
Jan.	... 8,000	3,250	5,800	224,500	9,500	39,000
Feb.	.. 7,500	2,721	4,700	180,691	9,500	24,000
March	..10,465	4,672	7,030	246,500	12,000	43,000
April	..10,860	4,350	6,400	233,700	12,000	43,000
May	...12,017	4,887	6,734	270,000	13,500	50,000
June	..12,215	4,868	6,282	259,100	16,000	47,000
July	...12,000	4,220	5,470	238,500	13,250	33,000

THE GEOLOGICAL SURVEY.

Mr. A. P. Low has been in Victoria, on his way to Mexico, and was interviewed by the Colonist, with the following result:

"The geological survey under Mr. Templeman's direction will probably get much more consideration from the government than it formerly did under the the Ministry of the Interior. Being now a minister of department he will undoubtedly see that British Columbia shall get its due share of the services of the staff of the geological survey and with that as a nucleus a department of mines will probably be formed with Mr. Templeman at its head, larger, more efficient and practical than at present and the study of the mining industry, in the matters of advice, reports on special minerals, maps, statistics, etc., will be made more of a specialty and with this practical phase of the question I identify myself with hearty sympathy. From here I go to Mexico City to attend the International Geological Congress to be held there in September, which meets every three years, usually in Europe, and comprises amongst its members all the chief geologists of the world. I leave to-night and am sincerely sorry that pressure of time and business has prevented my seeing more of the mining interests of this country now. I regret to say I am not even able to visit Nanaimo, Crofton, and the mines of Vancouver Island this time but I nevertheless hope to do so next year."

In relation to the work of the survey and its aims he said that ordinary surface maps showing only the streams, etc., were of little utility, even if absolutely correct, and it was the intention of the government to issue sheet maps in connection with its reports from which a better idea of the surface could be obtained. He hoped to have the survey work extended to such a degree that the topography of the country could be shown with some degree of accuracy, together with the contour and geological formation as was done in many parts of the United States. On taking stock of the official reports of the department he had been astonished at the accumulation of volumes from which the public are deriving no benefit. He had succeeded in having this system abolished and these reports were now being supplied to all Canadian applicants free of charge, on applications from the United States a charge was made for these reports but this was only because Canadians were charged by the United States geological survey for any reports procured from them. It was also the intention to publish preliminary reports each year from all points instead of keeping the public waiting until a full report can be compiled for each section traversed.

BOOK REVIEWS.

Receipt is acknowledged of:—

The Mechanical Engineering of Collieries, by T. Campbell Futers. Part II. Published by the Chichester Press, 30 and 31 Furnival St., Holborn, London, E.C.

Mica and the Mica Industry, by George Wetmore Colle, M.E., M.Sc. Published by the Franklin Institute, Philadelphia.

The Cyanide Process, an introduction to the. By Alfred S. Miller. Published by John Wiley & Sons, New York.

The following bulletins issued by the U. S. Geological Survey, Charles D. Walcott, Director:—

The Cement Industry of the United States. Edwin C. Eckel.

The Production of Steel-Hardening Metals. Joseph Hyde Pratt.

The Production of Tin. Frank L. Hess.

The Production of Mineral Waters. Myron L. Fuller.

Peat in the United States.—Miruis R. Campbell.

The Production of Zinc. Charles Kirchhoff.

The Production of Carbon Dioxide. Myron L. Fuller.

The Production of Magnesite. Charles G. Yale.

The Production of Phosphate Rock. Edmund Otis Hovey.

The Production of Salt. Edmund Otis Hovey.

The Production of Abrasive Materials. Joseph Hyde Pratt.

The Production of Quicksilver. F. W. Horton.

PERSONALS.

L. W. Stabler, a Butte mining engineer, visited Franklin camp recently for the purpose of inspecting work done on the McKinley group, now under bond to the F. A. Heinze interests.

Mr. E. T. Hannam, the inventor of the Atlas Water Tube Boiler, died at Chicago, at 4 p.m. Saturday, August 18th, just as he was entering a train. His death was due to heart disease.

J. M. Broucher, of the Brownell Company, Dayton, Ohio, has resigned his connection with that Company to accept the position of Assistant General Managership of Sales for the Atlas Engine Works of Indianapolis.

Col. W. J. Sutherland, president of the Alaska-Perseverance Mining Company of New York, and Mr. P. P. Pope, one of the directors, have been in Juneau, Alaska, and inspected the company's properties near that city.

Prof. Clement D. Child, Ph.D., of Colgate University, Hamilton, N.Y., has been selected to fill the chair of Professor Physics in the School of Mining, Kingston, and which carries with it the appointment of Professor of Physics in Queen's University.

Messrs. C. H. Macnutt and E. C. Vigeon are accepting the management of the Sociedad Minas de Cobre de Cutter Cove in the Straits of Magellan on leaving their present positions with the Societe des Mines de Cuivre de Catemu, Chile. They will also do consulting work.

Mr. Hubert Carmichael, Provincial Assayer, is visiting Alberni, Gardner and Observatory inlets, and, if time permits, the Queen Charlotte Islands. Mr. Carmichael visited the Queen Charlotte group in 1901, but there have been several promising discoveries made on the island since that day.

Howard E. Troutman, for over ten years connected with the Buckeye Engine Company and for several years manager of its Chicago office, has resigned to accept the sales management, Corliss and High Speed Engine Department of the Atlas Engine Works, Indianapolis. Mr. Troutman's headquarters wil be at the home office.

J. P. Johnston, for several years past the General Sales Manager for the Weber Steel Concrete Chimney Co., Chicago, has resigned to become Sales Manager, Water Tube Boiler Department of the Atlas Engine Works, Indianapolis. Mr. Johnston's offices will be at the Company's plant in Indianapolis.

Mr. W. H. Whiteside, President of the Allis-Chalmers Company, Milwaukee, represented in Canada by the Allis-Chalmers-Bullock, Ltd., returned on August 22nd, from a two months' combined business and pleasure tour of England, France, Germany, and Switzerland. Mr. Whiteside inspected various large manufacturing industries of England and on the continent, among others he visited the plants of the leading English steam turbine builders, whose American rights for building Parsons steam turbines for marine and land use, are enjoyed by the Allis-Chalmers Company.

Freight Traffic Manager Wm. Sproule of the Southern Pacific, has accepted the traffic management of the American Smelting Refinery, the American Smelting Securities Company, the Smelters' Steamship Company and a score of smaller corporations, including railways in Nevada and Alaska, and smelters and mines both in North and South America. On the Pacific Coast alone these companies own smelters at Tacoma, Everett, San Francisco and Selby. Their properties in Utah, Colorado, Nevada, Mexico, and South America are immense. Sproule entered the service of the Southern Pacific as a clerk in the freight department, in 1882, and leaves his high traffic position in the West after twenty-four years of continuous service.

MINING NOTES.

The investigations into the commercial possibilities of electric smelting of iron ore which were published by Dr. Haanel some time ago, are bearing fruit.

It is understood that a big steel firm of Pittsburg is preparing to put up an electric smelting plant at some point in Canada where the water power and ore are available.

Six months hence an electric smelting plant capable of turning out twenty tons of pig iron a day will be in operation in California. It is being installed by Dr. Herault, of France, who erected the experimental station at Sault Ste. Marie, under arrangement with Dr. Haanel. The California plant is to be eventually enlarged to an output of six to eight hundred tons a day.

The Michigan copper country possesses the world's three deepest vertical mining shafts.

The deepest of these is the No. 3 at the North Tamarack property, its measurement being 5,200 feet—eighty feet less than a mile. To the south, at a distance of 4,000 feet, is the No. 5 shaft of the same company. This ranks as the second deepest vertical shaft on the globe, its measurement being 5,080 feet from the collar to the bottom level.

Second only to these great openings is the Red Jacket, of the Calumet and Hecla Company, which is down 4,900 feet, and in which the copper lode was not encountered until a depth of 3,300 feet had been attained.

The deepest incline shaft in the world is the No. 4 of the Calumet and Hecla. This shaft itself, from the collar to the lowest level, is sunk on the plane of the lode for a distance of 8,100 feet, while from a drift at the bottom a winze extends downward 190 feet to the boundary of the property, giving a measurement of 8,290 feet from the surface. No. 4 shaft passes by the Red Jacket shaft at the fifty-sixth level.

The iron and steel bounty payments paid by the Dominion Government for the financial year up to July 1st amount to $2,004,339, as compared with $1,540,203 in 1905. The payments indicate a very large increase in the output of the Canadian iron and steel industries.

Bounty amounting to $687,631 was paid on a total output of 581,858 tons of pig iron; of this, 86,523 tons was made from Canadian ore. The bounty on this was at the rate of $1.65, and totalled $142,263. 495,335 tons were made from foreign ore. The bounty on this was at the rate of $1.10, and totalled $544,868.

Last year's output of pig iron was 386,719 tons, of which 327,267 tons were made from foreign and 59,452 from Canadian ore. The rates of bounty were higher; however, last year, viz., $1.50 on foreign and $2.25 on Canadian ore, so the total amount paid as pig iron bounty, was $624,167, of which $490,401 was on foreign and $133,766 on Canadian ore.

Of steel ingots, 569,237 tons were made in the Canadian mills during the past year, as compared with 272,916 tons in 1905. The bounty in 1906 at the rate of $1.65 per ton, was $941,000. In 1905, at the rate of $2.25 per ton, it was $614,433. Of puddled bars, 3,560 tons were made in 1906, as compared with 3,509 tons the year before. The bounty, at $1.65 per ton, this year, was $5,875. The payments last year at $2.25 per ton were $7,895.

The Government paid a bounty in 1906 of $369,832 on 72,875 tons of rolled angles, wire rods, plates, etc. In 1905 the payments were $293,208, and the output 59,842 tons.

These iron and steel bounties expire next year unless they are renewed by Parliament. The bounty rate on pig iron from Canadian ore and on puddled bars and steel ingots this year is $1.05 per ton. The rate on pig made from foreign ore is 70 cents a ton.

BOUNTY ON LEAD.

The lead bounty in 1906 totalled $90,197, as compared with $330,645, the year before, the rate of bounty being much lower on account of the higher price of lead in the world's markets.

The petroleum bounty, at the rate of 1½ cents per gallon, showed payments amounting to $291,157, as compared with $350,047 in 1905.

QUEBEC.

The latest mineral find to be added to the Province of Quebec's already long list of economic ores is red hematite. This metal has been discovered in the southern part of the province, near Dunham, and mines are already being opened up. The belt in which the mineral appears most freely is about eight miles long, and consists of a strip of land encircling the base of Little Pinnacle mountain.

The Little Pinnacle is just on the boundary between Vermont and Canada, and the find is distributed between the two countries, although Canada has by far the larger share.

ONTARIO.

The ratepayers of Sturgeon Falls have approved of a bonus to the Northern Ontario Smelting and Refining Company by a vote of 330 to 1. Such a practically unanimous vote shows the faith the townspeople have in the proposed undertaking.

The pyrite mine at Bogart, being operated by the American Madoc Mining Company, is to be operated on an extensive scale in the near future, and a plant will be erected for the treatment of the ores. The Baskin Bros., of Norwood, have taken the contract of building a siding to the mine from the main line of the C.P.R.

Gold has, it is reported, been discovered in Playfair township, in New Ontario, north of the height of land, by a miner from Lexington, Kentucky. The find was made 85 miles north of New Liskeard, and three miles from the Government railway. The samples were at once forwarded to the Government offices for analysis, and the result is said to be most satisfactory.

The mines branch of the Department of Interior will shortly be installed in the Thistle building on Wellington street, Ottawa. It will occupy the first, third and fourth floors, the second floor being tenanted by the United States consul-general. On the fourth flat there will be installed an assay office, and there the staff will be instructed by Dr. Haanel in the magnetic method of locating ore bodies.

It is said that the experiments in refining ores from Cobalt, which are being made in Hamilton, have been satisfactory, and the result is that a large establishment will be built there.

Seven or eight of the best mining companies at Cobalt are interested. A sample of ore recently assayed showed the following results per ton: Silver, $1,800; cobalt, $175; nickel, $40; total, $2,015.

The Cobalt Refining Company is using a portion of the old Hoepfries refinery, but it has an option on five acres of land adjoining this property.

Work has been re-commenced at the big steel plant of the Northern Iron and Steel Co., at Collingwood, after being idle for about two years. The company has been successfully financed, and will be turning out finished iron and steel shapes and bars shortly. The company will start with a large volume of orders on its books. Gangs of men are at work going over and fitting up the machinery ready for rolling and making steel. The superintendent of one of the big American steel plants has been employed to take charge of the mills.

COBALT.

There is a popular idea that the Cobalt boom is over because some five thousand green prospectors were chased out of the district this spring by a combination of lack of success, and black flies. Up to the latter part of July the black flies, mosquitoes and sand flies were so rife that they made prospecting in the thick brush almost impossible. Added to this the new prospectors instead of spreading out over the country confined their operations principally to the area around Cobalt which has already been prospected on the surface. Those who hope to make strikes in that vicinity now must trench for discoveries. Any surface indications were all located last summer.

Another feature which tended to dull the interest in the camp was the determination of the shipping mine owners not to ship any more ore to the States. Last year they were forced to ship in order to realize enough money to declare dividends and provide for development. But they recognized that it was robbing their mines to send ore to Jersey City because the monopoly smelter paid only for their silver and kept all the rich by-products. This summer all the large mines are storing their ore and waiting for the completion of the Hamilton smelter. Last month one well-known property had 200 tons stored that would run from $1,000 to $1,500 to the ton, and another was reported to have $1,000,000 worth of ore either bagged or blocked out. Meantime most of the mines are clearing off the surface of their properties and finding rich veins under the surface earth.

Semi-official corroboration of the story of the rich gold find in the township of Playfair has been received at the Department of Mines, but the department has heard nothing official of the five-foot strip of solid silver said to have been found on the Nipissing Company's property.

The miscellaneous floating population of the early spring, consisting largely of amateur prospectors and investors, has departed almost without exception, leaving only a law-abiding assemblage of miners and of those in legitimate trade, so that only the constantly recurring blasts from the surrounding mines show that Cobalt differs from the prosaic character of an ordinary new village of Ontario. The only cause for trouble at present is due to several parties prospecting on the same mining lot, all trenching for discovery veins, with equal right in the eyes of the law. In those cases the party that has been at work for weeks digging unsuccessfully but hopefully, feels naturally sore at the intrusion of others, and threatened violence has been expressed in a number of instances of this description; luckily, whisky is absent and "guns" are few, so that to date these bickerings have all ended in words.

The older claims are beginning to be systematically worked—almost every mine has a shaft with the necessary steam hoisting and drilling plants. Shafts are being sunk and tunnels run, to block out and prove the mines, and a start is being made to recover from last season's dumps much of the valuable ore thrown aside in the hurry for rich returns. Milling plants are being introduced and the time will soon be passed when ore valued at hundreds of dollars a ton will be cast aside as of no consequence.

The future of Cobalt camp looks bright for several years to come, and there appears to be little doubt that continued development will lead to the discovery of many new veins while the sinking shafts will show a continuation of values in depth.—Ottawa Citizen.

ALBERTA.

The MacDonnell Dominion Government survey party has returned to Edmonton from the Peace River country. They believe they have discovered gold in paying amount, within 15 miles of the British Columbia boundary.

Mr. T. C. Denis, who is attached to the mines section of the Geological Survey, has just returned from a short trip to Pelican Portage on the Athabasca River some hundred and twenty miles below Athabasca Landing. He has been investigating the mineral reserves of Alberta, on behalf of the department, and the object of his visit to Pelican Rapids was to report on the present state of the hole sunk at that place some eight years ago, from which there has been a tremendous rush of natural gas.

Farther north in the vicinity of Fort McMurray boring operations for oil are being actively proceeded with. Two drilling rigs equipped to reach a depth of three thousand feet are now in this district.

BRITISH COLUMBIA.

Advices from Quatsimo say that a big strike of bog iron has just been made to the north of the West Arm of Quatsimo Sound.

A forest fire completely destroyed the aerial tramway connecting the Hunter V. mine, near Ymir, with the Great Northern Railway, entailing a loss of some $30,000.

Work at the Hosmer mines is progressing satisfactorily. The main tunnel, 5,000 feet in length, is to be an exceptionally large one, twenty-two feet wide and ten feet high.

There is much mining activity reported in the vicinity of Cowichan Lake, Vancouver Island. The recent finds of copper-gold ores have stimulated further prospecting. As a result several claims have been recorded.

After a year's shut-down, the Stemwinder mine at Fairview, is preparing for extensive development, and a gang of men is engaged in excavating the rock on the south side of the 46-stamp mill for a foundation for an air compressor.

In the second quarter of the current year, ended June 30, the British Columbia Mining Company showed net earnings of $117,000. Owing to changes carried out at the plant production has been curtailed for about a month, and earnings will exhibit considerably under the $40,000 average of the preceding three months.

What is said to be the richest gold stake in Cariboo, B.C., within the past twenty-five years, has been made at Peter's Creek, near Stanley, by an old miner named Mathers. Mathers' discovery is the result of persistent prospecting and deep diggings. At the depth of 100 feet he is reported to have struck dirt that yielded thirty ounces of gold to the set of ten feet.

An eight-hour day is now in force at the St. Eugene concentrator. The request of the mill men was acceded to, and they will be paid at the rate of an eight-hour day. Therefore the men will be paid for a shift and a-half's work as long as they have to work twelve hours. But three eight-hour shifts will be worked as soon as possible. The "bull-cooks," or roustabouts, will work ten hours.

On August 21 the initial shipment of ore from the Dominion Copper Co.'s Idaho mine was sent to the company's smelter at Boundary Falls. It was also the first shipment to go out over the Great Northern and be transferred to the C.P.R. at Denoro, eight miles from Phoenix by either line. The shipment consisted of ten cars, or 600 tons of ore, and will be followed by others at regular intervals, somewhat relieving the other mines of the company from contributing their regular quota until the new furnace is received and installed at the smelter. This ore came from the tunnel level of the Idaho.

The most important developments of the past week have been in the Sandon-Slocan district, On Slocan Lake the record is one of steady development and gratifying results at Silverton, near Slocan City and on Ten-Mile Creek. The long-looked for strike in the big Rambler-Cariboo has rehabilitated Sandon camp. The lead has been struck in an up-raise and the long tunnel has still to be driven 400 feet, which will give it a total length of nearly a mile and a quarter. The mine contains a large body of comparatively high-grade ore, and it is now a matter of a few months only, until shipments shall be resumed on a bigger scale than ever.

Stockholders of the Granby Consolidated Mining, Smelting and Power Company will receive with their dividend cheques notice of the company's annual meeting in New York on October 2. The company's fiscal year ended June 30, and during that period net earnings were between $1,800,000 and $1,900,000. Copper production was just under 25,000,000 pounds. Next year's production is expected to show a still further material increase. A director thinks the production will be eventually considerably over the 50,00,000 pounds mark. The shares are in the hands of between 2,500 and 3,000 persons, as compared with about 900 in December, 1903, the time of the first dividend payment.

A dividend of 3 per cent. is payable September 15 on Granby Consolidated.

This is the third dividend of the Granby Consolidated made payable this year, each amounting to $405,000, each at the rate of three per cent. on the issued stock, there being 13,500,000 shares outstanding. This makes a total of $1,215,000 in dividends by this company thus far made payable in 1906, which is at the rate of nine per cent. per annum.

The dividend record of the Granby shows that thus far four declarations of this character have been made, the first being in December, 1903. The following shows the dates of payments of the dividends and amounts of each, the total of the four amounting to $1,348,630: December 19th, 1903, $133,630; January, 1906, $405,000; May, 1906, $405,000, and September, 1906, $405,000. Total declared $1,348,630.

Mr. Le Roy, the Dominion Geologist, is making a thorough examination of Texada Island, for the purpose of arriving at a conclusion in regard to the continuity, location and direction of the mineral veins of the island. Mr. Le Roy started to work at once in the vicinity of the Marble Bay mine. He stated that the Government noticed that large shipments of copper ore had been coming from British Columbia, and decided to send him to the different camps in the province to report on the geological formation of the ore zones, to prepare maps and plans, and to get full information for the benefit of the mining industry. Mr. Le Roy is now working on two large dykes which seem to carry the ore which is running parallel with them.

The Canadian Consolidated Mining Co. is still expanding, its latest purchase being the Iron Mask Mine, which will be operated on an extensive scale from the War Eagle workings, which are not far from the ore shoots in the Iron Mask Connections are already completed between the War Eagle and the Centre Star. The Iron Mask was operated in the early days of the Rossland Camp by the Iron Mask Gold Mining Co., which was organized Feb. 19, 1896. The development consisted of about 7,000 feet of horizontal and vertical working, and the main shaft has a depth of 450 feet. The ledges are not very wide, but the ore ran from $30 to $40 to the ton, carrying gold, copper and silver. The mine for a time paid profits, and accumulated $50,000 in its treasury, when it became involved in litigation with the Centre Star Mining Company.

From all parts of the province there continue to come reports of progress in mining, indicating such an output as will surpass the record of 1905, when the present year is completed. One gratifying feature is the continued extension of the smelting industry, says the Victoria Daily Colonist. In this connection there is a report that the Le Roi smelter at Northport, Washington, which has been lying idle for some time, is likely to be placed in operation again. If this is done, however, there seems a possibility of a renewal of the objection against the export of British Columbia ore to be smelted in a foreign country. The feeling that natural products should be manufactured at home, caused the recent legislation against the export of logs in the lumber industry. Still we are not in a position to say what effect the objection would have in regard to ore exported from British Columbia to be smelted in Washington.

It is announced that the Northport smelter is to be reopened and operated on ore shipped from the Le Roi mine. The Le Roi Company has been anxious to have its smelting plant in operation for several months past, and after considerable negotiations an amicable agreement was reached between it and the Consolidated Mining and Smelting Company. By the terms of this agreement the contract entered into last year under which the entire output of the Le Roi was to go to Trail for a period of three years, is cancelled. Since then the Consolidated Company has secured the Snowshoe mine at Phoenix and the Iron Mask in this camp, and owing to the discovery of new shoots of high grade ore in the Centre Star and War Eagle and a large increase in the quantity of custom ore from outside mines, there was no particular necessity for the Le Roi ore. Under the circumstances, the Consolidated was willing to cancel the contract. It is provided, however, that the Le Roi shall furnish about 75,000 tons of ore to the Trail smelter within the next seven months. It is said that there are such large reserves of ore in Le Roi that it will be able to keep the Northport plant in operation and at the same time furnish the 75,000 tons to Trail within the stipulated time.

A short time since announcement was made that a consolidation of several important mining claims in Phoenix would be made, including the War Eagle group, the new corporation to be called the Phoenix Amalgamated Copper Mines, Ltd. Information has now been received here that the consolidation has been carried into effect and takes in the War Eagle, Red Rock, Lulu, Bald Eagle, Dandy Fraction, Missing Link No. 2, Pinhook and World's Fair Fraction, continguous claims, that immediately adjoin the Granby Consolidated group on the south. The area of the properties is 210.30 acres, and comprises mineral territory that is favorably thought of by many who are familiar with the ground.

The Phoenix Amalgamated Copper Mines, Ltd., has been incorporated under the laws of British Columbia, with a capital of $5,000,000, having 500,000 shares of $10 par value each. Of this number 200,000 shares have been placed in the treasury of the company, the executive office of which is at Sherbrooke, Que., and the mine office at Phoenix.

The first board of directors of the new company is as follows: N. P. Buck, C. H. Fletcher, and C. A. French, of Sherbrooke, Quebec; George Vandyke, Boston; H. P. Buck, New York; W. J. C. Wakefield, Spokane, Wash.; George R. Naden, Greenwood; Charles Riordan, St. Catharines, Ont.; R. Bence Jones, Lisselan, Clonakilty, Ireland. The officers are: — F. P. Buck, president; C. H. Fletcher, vice-president; A. F. Fraser, secretary.

YUKON.

It is expected that the recent introduction of dredges will greatly increase the output of gold in the Klondike. In 1905 this was reduced to about $7,500,000 against $10,350,000 in 1904, $18,000,000 in 1901 and and $22,275,000 in 1900. Speculations are already rife as to whether this enlarged supply from the Yukon, coupled with Alaska's growing yield of new gold, will not perceptibly affect the general economic conditions in America as a whole. During 1906 Alaska will probably furnish some $20,000,000 of gold, as against $14,500,000 for 1905, $9,000,000 for 1904, and $6,350,000 for 1903.

Supt. Snyder, of the mounted police at White Horse, reports that "the month has witnessed a continuous boom in quartz mining, discovery after discovery being located and samples of ore are being brought in which are claimed to run from $200 to $600 to the ton. These discoveries were made in Watson and Wheaton River districts, at points from fifteen to twenty-five miles southwest of Robinson Siding, on White Pass and Yukon Railway.

"Although rich float has been found in these districts, since 1898, it is only this year that anyone has claimed to have discovered any ledge. Claims are purchased as soon as staked, there being good demand for them at prices ranging from $250 up."

Applications have been made for two town sites, one at the mines and one at Robinson Siding, at a point where the railway leaves to go to them. Work is being actively carried on in the neighborhood of Conrad, development work being carried on in about forty claims, employing in all about five hundred men.

Encouraging reports are received from various placer fields in the district, 1,025 ounces of gold being taken to town from Livingstone Creek in one week.

An application for 60,000 inches of water from Twelve-Mile River, one mile above its mouth, has been filed at the Gold Office in Dawson by L. S. Robe, H. G. Wilson, and F. J. Stackpoole.

The applicants state in their notice of application as posted in the Gold Office that they desire the water for the purpose of generating electrical power for distribution in Yukon Territory and Alaska. They also state that they plan to spend not less than $100,000 on the enterprise by the first of the year, and agree, if the grant is given, to have the plant working by October 15th of the second year after the grant is issued.

L. S. Robe, one of the applicants, was formerly mining engineer for the N. A. T. & T. Messrs. Wilson and Stackpoole are Dawson lawyers and solicitors for the N. A. T. & T. Robe is now in the Tanana.

The water to be asked for is to be taken from the stream some distance below the point of diversion by the Yukon Consolidated Goldfields Company, which is backed by the Guggenheims.

This is one of the largest applications ever filed in the Yukon for water. It is as great, if not greater, than that already issued by the Government to the Consolidated Company.

COAL NOTES.

NOVA SCOTIA.

The 20-year lease of the Port Hood Coal Company having been allowed to expire, others stepped in, and on August 27, took up the Minudie and Strathcona areas and five square miles at Port Hood. The matter has caused a lively sensation throughout Nova Scotia.

The output of the Dominion Coal Company's mines for month of August was :—No. 1, 45,825 tons ; No. 2, 54,941 tons ; No. 3, 38,464 tons ; No. 4, 50,886 tons ; No. 5, 59,251 tons ; No. 6, 9,933 tons ; No. 7, 11,891 tons ; No. 8, 24,566 tons ; No. 9, 35,959 tons ; total, 331,716 tons. Shipments amounted to 343,788 tons during the same month.

It is said the management of the Nova Scotia Steel and Coal Company are now about to enlarge their working areas. It was for this purpose the three heads of the company visited Boularderie. Since the day the Nova Scotia Steel and Coal Company first surveyed the proposed line of railway from No. 3 to Point Aconi in 1901, the matter has always been in the minds of Messrs. Cantley and Brown. They were aware of the fact that in these areas they had more coal than the company possesses elsewhere, and that some day they would be called upon to develop them. With the unprecedented demand for the output of their collieries at No. 3 and Sydney Mines, a demand which will be increased largely in a short time, the company have decided to again resume active operations at Point Aconi.

A report was current that a number of Canadian capitalists had made overtures to the Scotia Steel and Coal Company for the purchase of the Boularderie Island areas. There is little likelihood, however, of the deal going through just at present, as the company are firm in their intention of connecting their properties with their present railway system at No. 3.

BRITISH COLUMBIA.

Work at the Hosmer coal mines is progressing satisfactorily. The main tunnel, 5,000 feet in length, is to be an exceptionally large one—22 feet wide and 10 feet high.

THE MINING AND INDUSTRIAL SHARE MARKET.

(Specially reported for the CANADIAN MINING REVIEW by ROBERT MEREDITH & Co., Mining Brokers, 57 St. François Xavier St., Montreal.)

There has been very little of interest to note in the markets, during the past month.

In mining stocks, prices have remained firm, but the active trading in International Coal has quieted down, and more has been doing in some of the lower-priced stocks.

The industrial stocks remain stationary, and there has been practically no speculation in them.

News from the different mining camps is satisfactory, and is drawing public attention more and more to the industry.

In Rossland, especially, some fine veins of ore have been opened up.

There is practically nothing doing in the Cobalt stocks, with the exception of Nipissing, which is actively traded in on the New York "curb," and has scored an advance of some $3.00 per share.

The latest quotations are as follows:—

	Bid.	Asked.
Consolidated Mines	125	130
Can. Gold Fields	6	7
Granby Consolidated	12	12¼
Rambler Cariboo	30	32½
North Star	11	13
Monte Cristo	3	3½
White Bear	9	10
California	2	2½
Virginia	5	6
Deer Trail	..	1½
International Coal	64	65
Sullivan	7	9
Jumbo	15	18
Cariboo-McKinney	2½	3½
Denoro	7	8
Diamond Vale Coal	12½	18
Dominion Copper	3¾	4
Dominion Coal (common)	74	77
Dominion Coal (pref.)	..	..
Dominion Iron and Steel (common)	28¼	28¾
Dominion Iron and Steel (pref)	77	78
Intercolonial Coal (common)	..	..
Intercolonial Coal (pref.)	..	..
Nova Scotia Steel and Coal	67½	68
Nova Scotia Steel and Coal (pref.)	..	..

COMPANY NOTES.

The Salt Lake City district office of the Westinghouse Electric and Mfg. Company was removed on July 2nd, 1906, to 212-214 South West Temple Street, Salt Lake City, Utah. The Dallas district office was also removed on the same date to 418 Main street, Dallas, Texas.

INDUSTRIAL NOTES.

The Cobalt "Silver Queen" has purchased from Allis-Chalmers-Bullock, Limited, Montreal, through the Toronto office, an electric lighting outfit, including a "Bullock" generator driven by a high speed automatic engine, and additional boiler equipment.

Two 165 r.m.p. producer gas engines, manufactured by the Canadian Westinghouse Co., are to be installed in the plant of the Calgary Milling Company, at Calgary, Alberta, Canada. The engines operate at an altitude of 3,000 feet, using authracite coal for fuel, with possibility of a change to natural gas as soon as a supply is obtained.

The University Mine, Cobalt, has purchased from Allis-Chalmers-Bullock, Limited, Montreal, through the Toronto office, mining equipment including one-half of a duplex compound "Ingersoll" air compressor, "Ingersoll" rock drills, mountings, etc., two horizontal return tubular boilers and a "Bullock" generator driven by a high-speed automatic engine for lighting the mine, buildings, and camp generally. The contract included piping and connections for the complete outfit.

The Boundary iron works at Grand Forks was destroyed by fire. The origin of the fire is not known. The bulk of the patterns, valued at $8,000, were in a separate building and were saved. The buildings and machinery destroyed are valued between $15,000 and $18,000; insurance, $7,000. Managing Director Charles Brown announces his intention of rebuilding at once.

Strong and reliable, "Ingersoll-Sergeant" air compressors have just added one more good mark to their credit. The Tacoma Steel Works, of Tacoma, Washington, have ordered a large size compressor of the duplex steam and compound air class from Allis-Chalmers-Bullock, Limited, Montreal, through the Vancouver office, for their Marble Bay Mines, on Texada Island, about 80 miles north of Vancouver. This is to replace a smaller compressor built by the same firm which has been in constant and severe service for the past seven years. For one period of five months this smaller compressor worked continuously night and day.

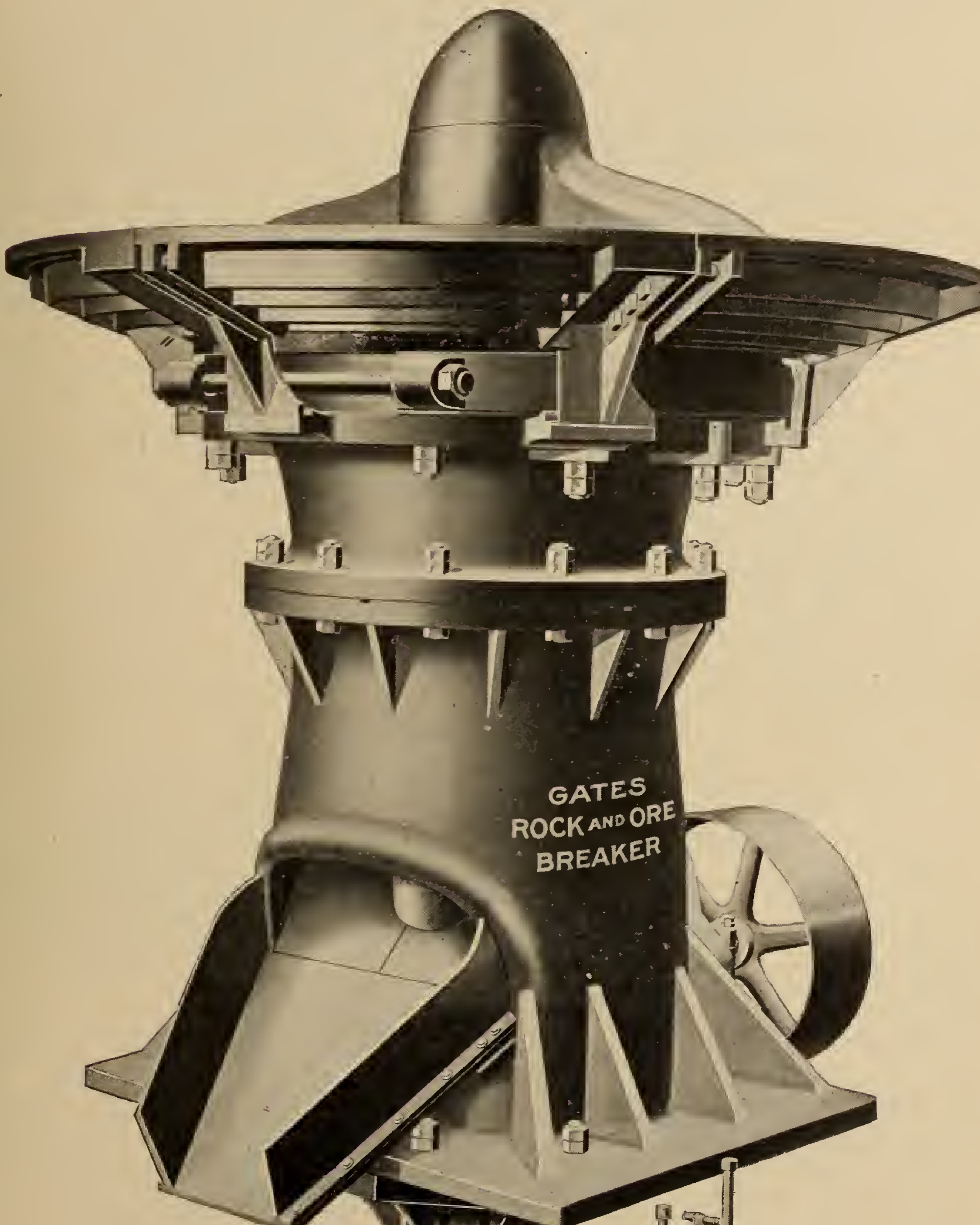
The Canadian Westinghouse Company, Ltd., are doing a large business in steam turbo-generator equipments. The Northern Electric & Mfg. Company, of Montreal, duplicated an order recently for a 300 k.w., Westinghouse-Parsons turbo-generator unit, to be installed in their power house alongside of one of the same capacity now in service. The generator is a 220 volt, thre phase, 7,200 alternation machine, operating at 3,600 r.p.m., and will be of the latest enclosed type, while the turbine will operate at 150 pounds steam pressure with 100 degrees superheat. Their present turbine is operating part of the year condensing, and through the winter non-condensing, the exhaust steam being used during the winter for heating purposes. It was the splendid operation of this steam turbine generating unit which led the company to order the one about to be installed.

A mammoth gold dredge for service on the "Forty Mile" in the Yukon was built this summer at White Horse and floated down the river to its destination. The timbers and machinery for this dredge were dispatched north from Vancouver, and the work of assembling it at White Horse commenced early in the season, so that the completed dredge was started down the river as soon as possible after the ice went out.

The mechanical equipment was ordered by the Forty-Mile Gold Dredging Co., of Toronto, Canada, through the Allis-Chalmers-Bullock Co., Ltd., Montreal.

The dredge equipment which was furnished complete is special in nature and adapted to the particularly heavy service of the Forty-Mile. The dredge proper will be equipped with 5 1-3 cu. ft. buckets. The accessory machinery, ready for operation, was shipped from the various works of the Allis-Chalmers Company. It consists of engines, pumps, boilers, concentrating machinery and a small electric light plant.

The largest generator ever made in this country has just been made ready for shipment to British Columbia from the works of the Canadian Westinghouse Company, of Hamilton. The purchaser is the British Columbia Electric Railway Company, of Vancouver. The generator is 2,000 horse power, 3 phase, 7,200 alternations, 200 revolutions per minute, engine type for direct connection with the water wheel. The order also includes one rotary converter of 1,350 horse power, 550 volts, 3 phase, 7,200 alternations, 400 revolutions per minute, and eight air blast transformers each of 733 horse power, 2,200 volts to 24,200 volts, 7,200 alternations. The necessary switch boards and regulating and controlling devices were also manufactured in this plant and will be shipped with the balance of the order in the course of a day or two.



The Gates Rock and Ore Breaker.

The new machinery is required by the Vancouver company to provide added power to meet the ever-increasing demand of Vancouver and vicinity. It is the fourth generator of the size ordered by the Vancouver company, but the other three were supplied by the Westinghouse company from its Pittsburg works previous to the building of the Hamilton works. The one now ready for shipment is by long odds the largest ever manufactured in Canad.

A recent appointment at the hands of Governor McInnes, acting for the Dominion of Canada, confers the title of consulting engineer to the Canadian Government upon Mr. Chas. T. Arkins, mining expert attached to the Seattle office of the Allis-Chalmers Company, represented in Canada by the Allis-Chalmers-Bullock Co., Ltd., Montreal. Mr. Arkins will act with the chief of the Geological Survey of Canada and the Government Mining Department in an investigation of the merits of the extensive deposits of "white channel gravels," so called, of Yukon Territory; and to report on the relative advantage of the mining and milling process over the sluicing treatment of these gravels for gold, which is the present method used. Water is scarce in that district and when used for sluicing purposes, it can be procured only through elaborate and expensive pumping and conveying schemes, involving an expenditure of approximately ten million dollars. The Government, with a view to avoiding this expense, has ordered this mining and metallurgical examination in order to determine upon the best mode of procedure.

Mr. Arkins is charged particularly with the metallurgical side of the investigation. The appointment, while it is temporay in character, comes as a personal honor and acknowledgment of Mr. Arkins' abilities as an expert as well as a tribute to the Allis-Chalmers Company, with whom he is associated. Mr. Arkins is now in Dawson, Y.T., where he will make the necessary preparations for undertaking his new work.

MINING INCORPORATIONS.

ONTARIO.

Verona Mining Company. Capital, $1,000. Head office, Toronto, Ont. George Herbert Smythe, attorney.

The Boston Mines, Limited. Capital, $50,000, divided into 50,000 shares of $1 each. Head office, Toronto, Ont. Provisional directors to be Frederick Rielly, George Verney, John Ross, Elmer Eugene Wallace and Arthur Roger Clute.

The American Silver King Mining Company, Limited. Share capital, $500,000, divided into 500,000 shares of $1 each. Head office, Haileybury, Ont. Provisional directors, Harvey Driffill Graham, George Aaron Bagshaw and Frederick Nasseau Hughes.

Right of Way Mining Company, Limited. Share capital, $500,000, divided into 500,000 shares of $1 each. Head office, Ottawa, Ont. Provisional directors to be George Patterson Murphy, James Barnet MacLaren, John Proctor Dickson and Edwin Septimus Leetham.

Cobalt Nugget Silver, Limited. Capital, $40,000, divided into 1,600 shares of 25c each. Head office, Haileybury, Ont. Provisional directors to be Arthur English Whitby, Vivian Reynolds Oliver, Cyril Thomas Young, Duran Fernando Hulbert, and Peter Stewart Hairston.

BRITISH COLUMBIA.

The Elk Valley Coal Company. Capital: $200,000, divided into 200,000 shares of $1 each. Head office, Victoria, B.C.

Empress Mining Company, Limited. Capital, $250,000, divided into 2,500 shares of $100 each. Head office, Victoria, B.C.

Recobond Mining Company, Limited. Capital, $10,000. divided into 10,000 shares of $1 each. Head office, Victoria, B.C.

Pacific Slate Company, Limited. Capital, $125,000, divided into 125,000 shares of $1 each. Head office, Victoria, B.C.

British Columbia Mining Exchange, Limited. Capital, $25,000, divided into 250 shares of $100 each. Head office, Victoria, B.C.

Northern Exploration Company. Capital, $500,000, divided into 500,000 shares. Wm. Ernest Burns, barrister-at-law, attorney. Head office, Vancouver, B.C.

CATALOGUES.

Round copper furnaces are dealt with in Bulletin M—106 published by the Wellman-Seaver-Morgan Company, Cleveland, Ohio.

The Atlas Engine Works of Indianapolis have published Bulletin No. 131, dealing with throttling and automatic single valve engines; a handsome publication of sixteen pages.

Conveying and Transmlsslon, are covered in a monthly publication published by the Stephens-Adamson Mnfg. Co. of Aurora, Ill., whose Canadian sales agents are W. H. C. Mussen & Co., Montreal.

The Wellman-Seaver-Morgan Co. of Cleveland, O., has issued Bulletin M—105, on silver-lead blast furnaces, which shows the latest design of silver-lead blast furnaces that the company is prepared to build in all standard sizes, from 30 x 60 inches to 42 x 160 inches.

The Sullivan Machinery Company have managed to work a vast amount of useful information concerning their machinery into the August number of Mine and Quarry. Mining men who have long adits to drive should be particularly interested in the description of the Gunnison Tunnel.

W. H. C. Mussen & Company, Montreal, are often asked the question, "What do you handle?" In order to give a comprehensive answer the house has brought out, for the use of purchasing agents and others, a reference list of machinery and supplies for railways, mines, contractors and municipalities.

DOMINION OF CANADA

SYNOPSIS OF CANADIAN NORTH-WEST MINING REGULATIONS.

COAL—Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of 10 cents per ton of 2,000 pounds shall be collected on the gross output.

A person 18 years of age or over having discovered mineral in place, may locate a claim 1,500 feet x 1,500 feet.

The fee for recording a claim is $5.

At least $100 must be expended on the claim each year, or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey, made, and upon complying with other requirements, purchase the land at $1 an acre.

The patent provides for the payment of a royalty of 2½ per cent. on the sales.

Placer mining claims generally are 100 feet square ; entry fee $5, renewable yearly

A free miner may obtain two leases to dredge for gold of five miles each for a term of twenty years, renewable at the discretion of the Minister of the Interior.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles. Rental $10 per annum for each mile of river leased. Royalty at the rate of 2½ per cent. collected on the output after it exceeds $10,000.

W. W. CORY,

Deputy of the Minister of the Interior.

The Bank of British North America

Established in 1836.

Incorporated by Royal Charter in 1840.

CAPITAL PAID UP	$4,866,667
RESERVE FUND	2,141,333

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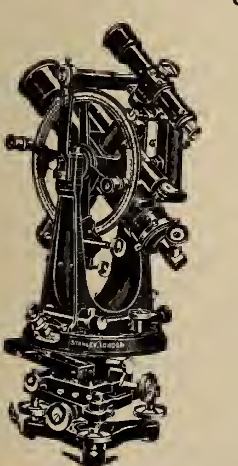

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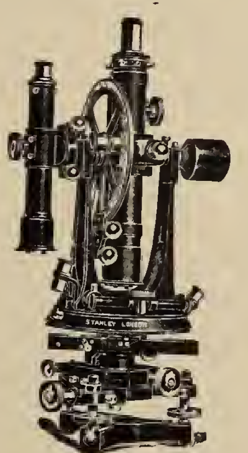

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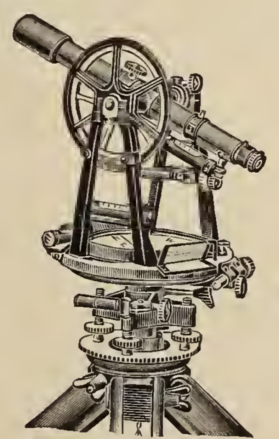

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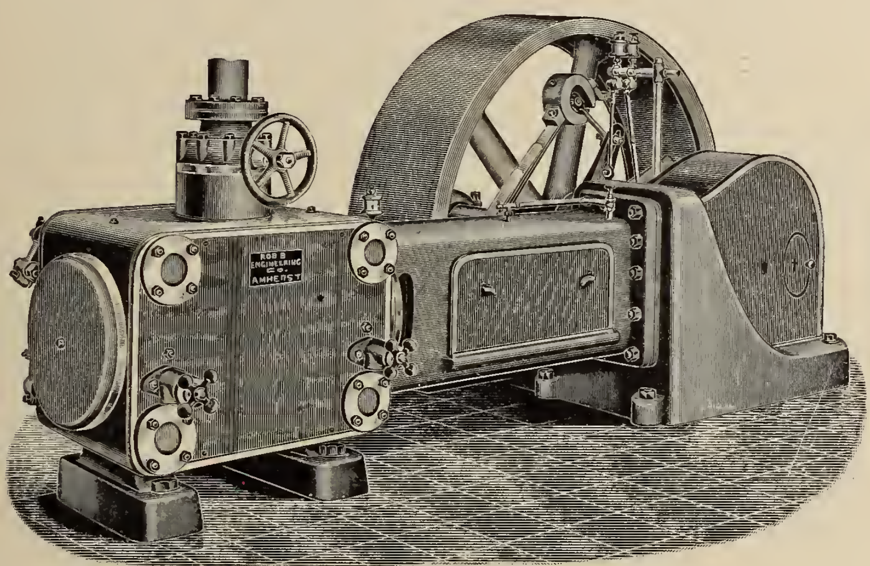

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24th YEAR OF PUBLICATION

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CONTENTS.

Are we to have a copper famine? A despatch from New York to the Canadian press states that there is no copper on hand, and that all the copper producing companies are sold out, and have contracts made that will run into next spring. Copper is now selling at 19 cents, and it is considered likely that the price will be 20 cents before the new year. It is certainly difficult to see how the price of copper can fall for some time to come.

Silver production has not increased in the same ratio as has gold production, which, together with the largely increased use of silver, has had a tendency to raise its price. It will be interesting to follow the rise of the white metal within the next few years. The United States Congress found it necessary last session to pass a law authorizing the recoinage of silver in the Philippines. This action was made necessary by a rise in the value of silver which caused the peso to be worth more as bullion than as coin. It has not been determined what ratio shall be employed in the recoinage.

Railway development is going on apace in the Dominion, yet, it seems impossible that it can be overdone for many a long year to come. Most mining propositions depend for their success upon transportation facilities, and any district that is not reached by the railway steel is out of it in more ways than one. We have regions in northern Quebec and Ontario that give every indication of becoming profitable mining fields, but which are not yet reached by any road, transcontinental or otherwise, and there are many meritorious prospects in British Columbia that will hardly be developed until some branch of our great railway systems penetrate to their seclusion. East Kootenay has been particularly unfortunate, but, now that there is said to have been a really big strike on the North Fork of Toby Creek, west of Wilmer, it is possible that relief may be forthcoming.

Last month the REVIEW printed on one of its editorial pages a note from a contributor which cast a slur upon the Ontario Government mining officials in the Cobalt district. In the hurry of the moment, we allowed this paragraph to go in without investigating the alleged shortcomings of the said Government officials; in this we were wrong, and we admit it, frankly. Since the appearance of the September issue, we have been at great pains to find at least one of the wrong doings that our correspondent hinted at, and we are pleased to be able to say that to the best of our belief, his suspicions are unfounded, as we have been unable to detect a single charge of malfeasance or improper conduct on the part of a Government official of the Cobalt region. As the strong limelight of publicity is cast upon all their actions, we think that any slip on the part of these gentlemen would have become public, and that we should have been, perhaps, the first to hear about it. It is our earnest endeavor to be fair and impartial, hence, this correction.

CHERISH THE PROSPECTOR.

In certain countries that are situated many, many miles beyond our borders, it is an accepted truism that an election cannot be carried without money; similarly, no new mining district can become famous without the assistance of the prospector. Hence, let us do what in us lies to encourage him to dwell in our midst. Anything that discourages the prospector gives a setback to the development of mining in a new country such as ours.

When mines have been opened, mills set agoing, railways built to carry ore and to bring in supplies and fuel, then a prospector becomes as useless as a soldier in time of peace. We have not reached such a state. The greater part of our north land is yet untrodden; large tracts are covered deeply by glacial drift; it is usually flat and float does not travel far. Under such conditions, prospecting is hard work, and it would be unattractive work were it not for the indomitable will, energy and love of adventure of the race. But we need the services of thousands of hardy, tireless, sharp eyed and sharp witted men, and unless we can send such out in sufficient numbers the development of the huge country between the Labrador coast and the Mackenzie is likely to be extremely slow.

With the discoveries at Silver Islet, Sudbury, Cobalt and Chibougamau before us, can we doubt that in the great lone land between the settlements and the Arctic Sea there lies to-day many a rich deposit awaiting the prospector? No sane man doubts it, and the other fellows are mostly in the asylums, though there are a few left wandering about our streets, who cannot see any future except eternal bankruptcy.

Let our law givers bear these facts in mind, and make the road of the prospector no more difficult than nature has ordained that it must be.

ALLEGED MINING ENGINEERS.

A great drawback under which the mining industry of Canada suffers is, undoubtedly, the self-styled, Mining Engineer. When he becomes a consulting engineer his power for evil is vastly increased. He is, usually, a glib-tongued, persuasive individual, with a fine nerve and sufficient education to write a smooth report.

His antecedents are always mysterious, and, generally, from the glimpses one is able to obtain of his past history, most interesting. Sometimes he starts life as a clerk in a broker's office, in others he is the ne'er-do-well of a respectable family, who, after being a pigeon during his callow youth, changes his plumage and becomes a rook in more matured life. He gets a smattering of mining terms; learns to look wise and keep his mouth shut; and with this slender equipment, aided by some good stationery, obtained on credit, he feels ready to pass judgment upon any investment in the world. More modest men may confine themselves to certain specialties; he knows no such limitations. He is equally at home on the floor of the smelter, in the stamp-room of the gold quartz mill, on the hurricane-deck of a dredge, or superintending the piping of gold-bearing gravel. If there ever was a re-incarnation of the Admirable Crichton we have him here —and all this wisdom may be obtained at cut-rate prices. Whereas, a competent and trustworthy consulting engineer may insist upon a fee of a couple of thousand dollars, the pseudo article will be only too glad to do the work for fifty; and the average Canadian mine owner, who has not learned wisdom, reasons that he is saving nineteen hundred and fifty dollars. Quite so; and if you want to see the handiwork of some of these consulting mining engineers, visit the Lake of the Woods country, and one or two other regions that will occur readily to our readers, mark the shafts full of water, the rusting mills, the abandoned buildings, and, if you would pursue the subject still further, try and find out the eventual fate of the widows, and orphans, and aged folk, whose little savings were put into these mines, and spent, under the direction of that prince of humbug—the self-constituted mining engineer.

Let us be thankful that we have in this country some of the most painstaking, scientific, conscientious mining engineers that the world holds, so that, we may rest assured, when we want an honest opinion as to the value of a property and the proper methods of its development, we shall have no difficulty in obtaining such advice, if we only use ordinary judgment in asking for it of the right man.

AN IMPORTANT DISCOVERY.

Mr. D. B. Dowling of the Geological Survey has found coal between the Saskatchewan and Brazeau rivers, on the flanks of the Big Horn range. There are four principal seams, and twenty minor ones, giving in all 114 feet of coal, of which 90 feet should be worth winning. The four thickest beds are 25 inches, 26 inches, 8 feet, and 16 feet respectively. There are in all fifteen workable seams.

The analysis of these coal seams is as follows:—

No. 1 Seam (South of Big Horn Range)	p.c.
Moisture	5.80
Volatile Matter	25.50
Fixed Carbon	62.60
Ash	6.10
	100.00

No. 2 Seam (South of Big Horn Range)	p.c.
Moisture	3.74
Volatile Matter	25.50
Fixed Carbon	67.00
Ash	3.76
	100.00

No. 3 Seam (South of Big Horn Range)	p.c.
Moisture	1.85
Volatile Matter	24.95
Fixed Carbon	69.70
Ash	3.50
	100.00

No. 4 Seam (Near Brazeau River)	p.c.
Moisture	2.50
Volatile Matter	27.10
Fixed Carbon	64.00
Ash	6.40
	100.00

Seam No. 5 (Near Brazeau River)	p.c.
Moisture	2.00
Volatile Matter	28.55
Fixed Carbon	60.75
Ash	8.70
	100.00

Seam No. 6 (Kananaskis River)	p.c.
Moisture	9.10
Volatile Matter	21.00
Fixed Carbon	57.90
Ash	12.00
	100.00

In each case the analysis was made by Mr. M. F. Connor.

TELLURIDE ORES IN SOUTHERN YUKON.

Mr. D. D. Cairnes, of the Geological Survey, has been, for some time past, mapping the country around Lake Bennett, in southern Yukon. He reported, in July, that quartz containing very rich gold has been found in the neighborhood, but that the quartz was only "float." Now, however, he is able to report that diligent prospecting has located the vein and from his letter on the subject, it seems likely that the Lake Bennett district will shortly come into prominence as a deep mining field. It has long been a matter of surprise that, in spite of the phenomenal results obtained from alluvial mining, not only in the Klondike district itself, but in many other placer areas, no important gold-bearing veins have yet been discovered. The Yukon, in fact, began as an alluvial field and has continued as such. The news from Lake Bennett, however, is such as to make one believe it probable that the Yukon will at last have its profitable deep-mining. What makes Mr. Cairnes' news the more interesting is the mention he makes of sylvanite. Sylvanite is one of the telluride ores and since the wonderful output from the Kalgurli field in West Australia, every gold prospector has been on the lookout for tellurides. The peculiar feature about these ores is that, though they may be phenomenally rich, they very seldom carry visible gold. The ores in the celebrated Great Boulder mine, of Kalgurli, went eleven ounces—$220—a ton, in the first crushing, and never showed a single speck of gold. The mine has averaged 17,000 ounces of gold per month for the past three or four years. In view of these facts concerning the best known telluride district in the world, Mr. Cairnes' letter makes one feel particularly hopeful. He says "the locality where the strike was first made and where there is the most excitement and best showings, at present, is between the Watson and Wheaton rivers, about 20 miles west of Robinson station, on the W. P. & Y. Railway.

"The main veins have been traced from the one river to the other, a distance of about 8 miles at least, quartz veins strongly resembling each other are found throughout this distance. The veins are from two or three feet to twelve and fourteen feet in width.

"Very high values are obtained. I have seen large pieces of the ore full of quite coarse free gold mixed with telluride minerals, chiefly sylvanite. I have tested samples myself and know ores to be full of tellurium in reliable assays made from "Gold Reef" quartz, which looked almost barren of mineral, and it runs $900. Values up to $200 are quite common. Samples carrying the sylvanite run up to $4,000 and $5,000.

"As no work has been done, not much can be definitely known as yet, in many respects, but there is plenty of quartz here and high values are obtained from some of the claims."

COPPER DISCOVERIES IN THE YUKON.

The association of Yukon and gold seems to be almost as natural as that of Manitoba and wheat, yet it is quite possible that, before many years are passed, Yukon and copper will seem a more intimate association than Yukon and gold. For, if the discoveries lately made in the Whitehorse district, develop in depth in anything like the same degree as they promise at the surface, southern Yukon will become one of the most valuable copper fields of the world. The Geological Survey, represented by one of its field officers, Mr. D. D. Cairnes, has during the past summer been making surveys in this district, and his reports, full details of which will shortly appear in the Department's Summary Report, leave no doubt that west of Whitehorse there are all the makings of a wonderful copper country. Mr. Cairnes, after remarking that, with the short time at his disposal, his knowledge of the geology and origin of the ores is naturally superficial, furnishes some very interesting particulars concerning development, from which we cull the following:—

"The latest and one of the most valuable discoveries in the camp has been made by Byron N. White, of Spokane, on the Pueblo. He owns it and several adjoining properties and came in here about three months ago, only intending to remain a few days, but has found things so interesting that in spite of his interests in many of the leading camps in the Western States he is still here personally supervising developments. With a small crew of men doing surface work, chiefly, Mr. White has uncovered on the Pueblo a body of ores 250 feet by about 270 and has sunk about 100 feet and has not, as yet, found either wall. The ore is almost solid hematite heavily impregnated with copper minerals. This whole body is practically shipping ore and will average in the neighborhood of 4 per cent. cu. with some gold values. There are masses and streaks, however, of high grade ore forming a large proportion of the ore body. Cuprite and copper glance occur in considerable quantities, with some native Cu., and bornite, chalcopyrite, and the carbonates are thickly disseminated throughout the ore: so that, with only rough hand sorting, high grade shipments can be made. It is certainly an enormous surface showing.

This combined with the large copper deposits of the Copper King, Copper Queen, Arctic Chief, Carlisle, and many others of this camp give good grounds for the general enthusiasm in the vicinity. Even the question of a local smelter in the near future seems a probability. Mr. White is shipping 100 tons of ore at present and ore buyers are negotiating for large shipments. I saw smelter returns from the Tyee Smelter of ten ton lots from the Copper King which went 46, 31 and 29 per cent. copper respectively and there appears to be no scarcity, even of these high grade ores.

A geological map of this area is being asked for on all sides by mining men coming into this district.

ABITIBI.

The remarkable richness of the samples of free gold recently discovered on the shores of Opasatika Lake, just south of Lake Abitibi in the Province of Quebec, would seem to give substantial indications of the existence of a valuable gold field in the vicinity. It is not on Opasatika Lake alone, however, that samples have been found—excellent specimens have been taken near the Hudson Bay post and also on the Whitefish River, quite near the projected crossing of the Grand Trunk Pacific Railway. It is the opinion of prospectors that the gold region will be found to be still further north and east and the construction of the Abitibi section of the Grand Trunk Pacific will be hailed with intense satisfaction.

Many years ago, Sir Wm. Logan, Canada's great geologist, predicted that the permanent wealth of this country would be found in the Great Huronian Belt, and it certainly seems as if the prediction may be fulfilled in the near future. This great belt finds its widest development East of Lake Abitibi, and, where not overburdened with heavy clays, the discovery of economic minerals seems reasonably certain. The belt is cut by the Bell River, which seems to be the Eastern limit of the clay, and from the height of land north for 150 miles the exposures are the Huronian rocks—diorites and greenstones.

The great mineral area, therefore, appears to be situated between Lake Abitibi and the Bell River, and, as we have already pointed out, where the rock is not too heavily overburdened with the rich clays, it would seem to us to be a promising field for the prospector. Still further East the same rocks crop out occasionally among the granites and gneises and at Lake Chibougamau nearly three hundred miles east of Abitibi, there is an outcrop of Huronian, that contains both gold and asbestos.

Fortunately for the Province of Quebec, Abitibi and east and north of Abitibi, mining will not be the only resource. There are millions of acres of excellent clay lands extending all the way to Lake Mattagami and even down to the shore at tidewater. Once a local market is created for the products of this rich virgin soil farmers will flock into the country and we may, in the near future, have a repetition of the North Western development in the North East. What is needed, however, to develop this new section is transportation. Transportation opens the way for the prospector: the prospector discovers the gold: the promoter secures the capital to develop the minerals, this attracts labor—laborers must eat and the farmer soon discovers that there is a ready and profitable market for farm products and the plough soon penetrates the wilderness—the frontier has been extended a few hundred miles—and a region of profound silence and desolation has suddenly been converted into a thriving community and development goes on apace.

This has been the history of the Great North West for years. By present appearances it looks as if it might be the history of the Great North East —the undeveloped empire in the Northern part of the Old Province of Quebec.

A NEW COPPER FIND IN QUEBEC.

It has ever been an open question in all the geological surveys of the world, as to exactly how far the geologists of the survey should refer, in their field reports, to private undertakings. That the question is a most intricate one, nobody will deny. By different governments it has been treated in different manners, and this, very naturally, for the kind of report furnished by a geological field officer must, to a large extent, depend on the mining laws of the country for which that officer is working. In those countries such as New Zealand and Australia, where a large reward is given for the discovery of a new "field," the Government geologist frequently advises as to whether the reward has or has not been earned. In some countries, the governments are prepared to help the miner—or the mining company—to the extent of sinking a shaft so many hundred feet, and in such cases it is usual to consult the Geological Survey as to the prospect of success.

In Canada, however, where the prospector gets very little encouragement from anyone or anything except his own stout heart and the knowledge that the country has hardly yet been scratched, our Geological Survey has been very chary as regards including in its reports any matter affecting private interests, and especially careful not to tread on anybody's toes. We are all the more pleased, therefore, to notice in this year's Survey Report the following rather startling paragraph, which occurs in a report by Dr. J. A. Dresser, on St. Bruno Mountain, Que. Dr. Dresser, it may be said, has made a special study of the copper-bearing rocks of the Eastern Townships, and is, therefore, likely to know what he is talking about. He writes, "On the sixth lots of ranges 2 and 3 of the same township a small amount of chalcopyrite two inches wide by two feet long, was visible for a time. A cutting of less than two feet into the rock removed all the ores as far as could be seen at the time of my visit. I am credibly informed that this property has been sold for $12,000, $3,000 of which has been paid in cash to parties in the state of Connecticut, and that a joint stock company capitalized at $500,000, has there been formed to acquire and operate the property. This occurrence, like many other copper stringers throughout this belt, is of no economic importance."

It is very doubtful if the report has been published in time to do much good, but it seems to us that here is precisely the kind of information that the public requires. We know, of course, that there are several powerful arguments against the advisability of publishing such statements in a general report, but none of these arguments gainsay the main fact that the public—through the Geological Survey—pay geologists to report on the geology—and principally the economic geology of the country—and that they expect a field officer if he comes across an evident swindle to report it.

The mention of such swindles does not necessarily mean any interference with legitimate private interests: the failure to point them out does necessarily mean an immense amount of harm to the district in which they occur. How many mineral deposits are lying idle to-day in Canada for reasons quite unconnected with the payable nature of the mine. Several fields that we could mention are lying idle—not because they cannot be profitably worked, but because the public will not supply the money to work them. And why? For the simple reason that the public have been gulled so often they are not prepared to take another risk. The Canadian is a good sport and is generally willing to accept a fair risk, but he has been bitten again and again, with the natural result that when a sound proposition comes his way, he is inclined to regard it with doubt.

We believe that the Geological Survey, in showing up such cases as we have quoted above, could very materially help the mining industry in Canada, and we trust that Mr. Low will put no such restrictions on field-officers as have too often been enforced in former years.

CANADIAN MINERALS.

The summary statement of the mineral production of Canada for the year 1905, issued by the Geological Survey, shows the total value to have been $68,574,707. This is considerably the largest in the record. In 1901 the total of $66,339,158 was reached. From that there was a gradual decline, till 1904, when the output was only $60,073,879. Before 1901 there had been a continuous increase from the figure of 1866, which is given as $10,221,255. This had grown to $20,648,694 in 1895, and to $64,618,268 in 1900, and reached the figure noted in 1905. There is no branch of industry that can show a more marked development. Moreover, the increase is likely to go on augmenting. There is no section of the country where there are not evidences of improvement in the general situation, which give promise of an increasing demand for all of the varied materials that come within the accepted classification of minerals, and there are few sections of the country in which mineral products useful in the arts and industry are not found.

The report divides the products into two classes, metallic and non-metallic. The former has risen to first place in the value of output. The total credited to it last year was $37,150,830. The details are:—

Gold	$14,486,833
Nickel	7,550,526
Copper	7,420,451
Silver	3,605,957
Lead	2,634,084
Pig Iron	1,047,860
Iron Ore Exports	125,119
Cobalt	100,000
Other Metals, including Zinc	180,000

Gold is in the lead, owing chiefly to the contributions of the Yukon, which are placed at $8,327,000, a considerable sum, but less than has been credited to the northern country in former years, and indicating, therefore, that the placer, or poor miner's fields, are becoming exhausted, and that, unless the costly works now in contemplation are carried out, and prove successful, the decline of Dawson City is likely to be rapid. The amount credited to copper is the value at 15.59 cents a pound of the estimated quantity in the ore and matte. Nickel, in like manner, is valued at 40 cents a pound, lead at 4.70 cents a pound, and silver at 60.352 cents an ounce. The refining process is not carried on in Canada in a general way yet, nor is it likely to be until there is a considerable increase in the production of the ores to which it has to be applied.

The non-metallic category is credited with an output value of $22,266,393. The leader, as usual, is coal, the 8,775,993 tons produced during the year being valued at $17,658,615. The increase in the coal trade has been notable, the output having doubled in seven years, partly through the development in iron, which began to be important about 1900, when the production from Canadian ore was 35,387 tons. The growing demands of the railways have also been a contributory impulse, as well as the growth in manufacturing industry, which, in spite of what has been said about "white coal," still seems to find it profitable to rely largely on the black article. Next to coal in importance in the non-metallic category comes asbestos, largely a product of the Province of Quebec. The output in 1905 was valued at $1,486,359. Petroleum, in spite of the bounty paid on its production, is the basis of a declining industry. It is credited last year with 634,095 barrels, valued at $849,687. In 1901, 622,392 barrels were valued at $1,008,275, and ten years ago 726,138 barrels were valued at $1,086,738. In the declining industries are included natural gas, salt and phosphate production.

The third division of the list is devoted to structural materials and clay products. The production of the year was $8,857,484, of which building material, including brick, stone, lime, etc., accounts for $6,095,000, and cement for $1,924,000. The development of the cement industry has been notable. In 1891 the production was 93,473 barrels, valued at $108,561. By 1901 it had reached 417,552 barrels, and last year it was 1,360,731 barrels. The more this material is understood the greater does the demand for it appear to be. At first it was generally used as a cement in place of lime mortar on the better class of buildings and masonry works. Then railway and canal engineers began to utilize it for piers, abutments, walls, etc. Now it is used largely in street construction, for the protection of the steel work of large buildings, for foundations, and in an increasing way for the walls of houses and industrial establishments. It is likely, therefore, that this branch of mineral industry will continue to expand and to add to the importance of the whole.

MR. A. P. LOW IN BRITISH COLUMBIA.

Mr. A. P. Low, Director of the Geological Survey, has lately returned from a flying visit to British Columbia, a visit, which owing to the late adjournment of Parliament and to business connected with the transfer of the Geological Survey from the charge of the Minister of the Interior to that of the Minister of Inland Revenue, was much shorter than originally intended. However, even in the brief time that the director was able to devote to personal inspection of the mining areas, and in making and renewing acquaintances with the prominent mine managers, he was able to do a considerable amount of work, and he has returned more than ever impressed with the capabilities of British Columbia as a mineral province. When it is remembered that only a few years ago one of the Survey officers commenced a portion of his report with "There being no copper works in Canada," and that last year the copper production of British Columbia alone was 48,000,000 lbs., the progress has indeed been astonishing.

Mr. Low first visited the coal mines of East Kootenay. He found that at Fernie and at Michel a large output of coal and coke is being made from the mines and ovens, which are not only operated to their full present capacity, but new workings are being opened to increase the output, for which a ready market is found, both in our Dominion and the adjoining portions of the United States.

Since that momentous summer of 1890 when two prospectors located in a few hours what are now the world renowned mines, LeRoi, Centre Star, War Eagle and Idaho, few mining districts have experienced a more romantic career than Rossland. The booming of the LeRoi shares in London, Eng., the sudden collapse of the Standard Mining Company and the trial and sensational suicide of the unfortunate Whittaker Wright, combined to form a chapter in mining romance seldom equalled. After the suicide and the seeming hopelessness of securing sufficient capital to continue mining operations the Rossland mines were on the point of shutting down, and it was largely owing to favorable opinions expressed by the Geological Survey that work was continued. Naturally, therefore, the Survey takes a sort of parental interest in the operations of the Rossland camp, and naturally Mr. Low included it in his visit.

Both in Rossland itself and in the vicinity a distinct revival of mining has taken place, owing to the discoveries of richer ore in the deeper parts of the principal mines, discoveries which Mr. R. W. Brock, acting for the Survey, had predicted with considerable confidence. The work of Mr. Brock and of his confreres is much appreciated in the district, more especially owing to the renewed confidence it has imparted both to mine managers and prospectors. At Trail, etxensive alterations and additions were being made to the smelter, and similar improvements are taking place in Nelson, Grand Forks, Greenwood and Boundary, showing that the output of the mines supplying these furnaces is of such a nature as demands more extensive and bettei plants for its treatment. All the mines of the Boundary copper camps were active and their general tone appeared to suggest healthy improvement without any sign of an undesirable boom.

A hurried visit was made to the silver lead districts of Slocan showing an awakening there also; several mines are working profitably.

The finding of the vein of the Rambler-Cariboo mine at a depth of more than 1,200 feet chanced to be coincident with Mr. Low's visit, and is of the greatest importance to the district pointing as it does to the probability of the silver and lead ores being found at a depth previously unknown.

At Hedley, in the Similkameen Valley, the large Nickel Plate mine was visited and a trip was made over the adjoining properties. These give surface indications of large ore bodies and when the railway freights are reduced to a reasonable figure it is expected that these ores will prove payable.

Mr. C. Camsell, who was working along the Similkameen Valley, above Princeton, was seen at Hedley and was quite enthusiastic about the large masses of ore in that region, which, although low grade, can, he confidently believes, be profitably worked, upon the completion of the railway.

The coast was reached on the 22nd of August, when Mr. LeRoy who was working on the coast section about and to the northward of Vancouver made very favorable reports concerning the mineral deposits both of the mainland and Texada Island.

Summed up, the result of Mr. Low's visit to southern British Columbia showed a renewed and increased activity in mining at all mining centres, and he came away with the feeling that the operations are now being conducted throughout those districts in a solid and legitimate manner with the object in view of making money, not from speculative dealings in shares, but from the actual output of the mines. That this visit of the director, which we trust will be of annual occurrence, will result in much mutual benefit to the mining interest and to the Geological Survey we make no doubt. Mr. Low's endeavor to meet personally the principal owners and operators of the several camps, and where possible, to freely exchange ideas as to the present and future work of the department is, we feel sure, a step in the right direction. By this means and by this means only can a clear understanding be obtained as to the desire of the Department to help in every possible way the mining interest of Canada; at the same time the Director receives valuable suggestions as to the manner in which such help may be given and these suggestions, we are sure, will be acted upon as far as circumstances permit, thus increasing the usefulness of the Geological Survey.

THE KNORR METHOD OF DETERMINING ARSENIC AND ANTIMONY IN REFINED COPPER.

By P. Butler, M.Sc. (McGill.)

This method was originated in 1901 by Mr. A. E. Knorr, chemist, with whom the writer was associated, in the laboratory of the Guggenheim Copper Refinery, at Maured, New Jersey.

The bulk of the copper is first separated from the impurities; then the arsenic and antimony are separated from each other by distillation, making use of a special distilling apparatus designed by Mr. Knorr for the purpose.

This apparatus can be purchased at a reasonable price from E. Machlett & Sons, New York City.

It consists of three parts — distilling flask, thistle-tube with dropper regulated by stopcock, and bulb-condenser—all connected by ground glass joints and conveniently attached to an ordinary iron rod imbedded in the work table.

(I) Separation of copper from As., Sb., Sn., etc.:

100 gms. refined copper turnings (or sawings) are weighed into a one-litre Jena beaker, covered with water and completely dissolved by the gradual addition of 400 cc HNO_3 (conc.)

The solution is then evaporated slowly on a hot plate until all excess of free acid is driven off—this is recognized by the crystallization on the sides of the beaker of basic copper nitrate.

The neutral solution is now diluted with hot water to a bulk of about 600 cc, brought to a boil, and a pinch of powdered $KClo_3$ added.

Then, while gently agitating with a glass rod, about 0.6 gms. ferrous sulphate (free from As., and Sb.) is added and the solution boiled for two minutes and then removed from the heat.

The iron will be precipitated as Fe_2O_3 in a granular condition which, upon standing a few minutes, will rapidly settle, carrying down with it all arsenic, antimony, tin, etc.

This precipitate can readily be filtered and is then ready for distilling.

(II) The Distillation:—

The precipitate is dissolved through the filter by HCl (sp.gr. 1.17) into the distilling flask, care being taken to use a minimum amount of acid.

10 c.c. H_2SO_4 (conc.) is then added and the apparatus connected together, a little H_2SO_4 being used on the glass joints as a seal.

Through the funnel of the thistle-tube is added 10 to 15 drops hypophosphorous acid (10 per cent.

solution) and washed through with enough HCl (1.17) to fill the flask not more than 1-3 full (estimated).

Moderate heat is applied to the flask and the solution distilled into a beaker of cold water, care being taken to maintain as nearly as possible a constant volume in the flask, regulating the dropping HCl (1.17) from the funnel by means of the stop-cock in the thistle-tube.

The beaker containing the distillate should be kept cool (by suitable cooling bath) and should be changed at intervals of 10 minutes.

Generally, two distillates of 10 minutes each will contain all the arsenic, but an extra one should always be tested for arsenic as a matter of precaution.

No antimony will be distilled over if the solution in the flask is maintained at a volume of about 30 to 40 cubic cent.

The arsenic can be precipitated as a sulphide and filtered through asbestos on a weighed platinum gooch, the free sulphur being removed by washing with alcohol (ethyl) and CS_2, and drying with ether and weighing as As_2S_3.

To obtain the antimony slow up the dropping HCl and increase the heat until SO_3 fumes begin to appear in the condenser.

Maintain at this temperature for one hour or until all the antimony is over, changing the distillate at intervals and testing with H_2S.

The beaker for antimony distillate should contain a little tartaric acid to prevent formation of $Sb_4 O, Cl$.

Unless tin is known to be absent, the antimony should be precipitated in an Oxalic acid solution by means of H_2S (separation from Sn_2S_3) and weighed as Sb_2S_3, the sulphur being eliminated as in the case of arsenic.

The writer has used this method continuously for the last five years and has found it to give extremely accurate results.

In slightly modified form this method has been used by the writer in analyzing ores, mattes, babbitts, base bullion, copper electrolytes and blister copper.

THE NEW SMELTING.

By Alfred W. Dyer.

The introduction of the Huntington-Heberlein process, together with the employment of a novel system of ore crushing and sampling, has practically renovated the art of lead smelting at the Hall Mines Smelter in Nelson, B.C. Face to face with an irregular and uncertain supply of ore, now happily improving under better conditions, with severe competition both at home and abroad, with labor laws that have increased the number of men employed at the works through shorter hours, with an inconvenient and cramped position on a hillside, the smelter having originally been built for the treatment of the ores of the Silver King mine, the smelter management have been able, despite all these adverse conditions to expend close on to \$100,000 in renovating their works. These profits were made from the apparently precarious supply of the Slocan and East Kootenay lead ores. They are now in a better position than ever to take advantage of conditions that are so greatly improving the lead miners' prospects, and to earn those profits for the English shareholders, which they deserve because of their business acumen and because of their persistent faith in the west of Canada.

That which is true as regards the newer methods of treating lead ore at Nelson is, also, true of the smelters at Trail and Marysville.

The Hall mines smelter has now a capacity of some 200 tons daily and employs about 130 men. Custom ore, on which it is wholly dependent, is brought to the new crusher and sampler, alongside a C.P.R. siding. This plant, nearly all made by the Colorado Iron Works, has cost the company \$30,000 and is just completed. The ore is first passed into an ordinary crusher at the platform level. Falling through, it is fed automatically and regularly, no matter the speed at which the crusher is working, into an elevator which takes it to the top of the building. Thence, if required for sampling, the ore drops into a Vezin sampler which rejects four-fifths of the flow, going into a reject bin outside, and passes one-fifth into an automatic mixer and feeder which sends the ore into a Gates roll, crushing it to 1½ inch.

From the 1½ inch Gates roll the ore drops into an automatic feeder as before and is taken up a second elevator, to the top of the building, dropping through a second Vezin sampler, where again a fifth of the flow is taken, which goes to a Colorado Iron Works roll, this time being reduced to ½ inch. It goes up a third elevator, through a third Vezin sampler, and 1-125th of the original carload is then taken through a third set of rolls, and brought down to ¼ inch, and is then taken through to the bucking room where samples are prepared for the assay office in the usual way.

But for the Heberlein process the ore has to be reduced to six mesh. Hence, the sampling not being necessary, or having been accomplished, the ore flow on reaching the chute leading to the first Vezin sampler, is turned by means of a swivel spout at the top of the elevator. Before it reaches the rolls, however, the ore flow is stopped by an impact screen which rejects all oversize, which is returned for recrushing. The ore flow is directed over the whole system of rolls as described, finally passing through a six-mesh, impact screen, into a feeder which distributes it evenly in a horizontal layer in the bedding bins immediatey behind.

All boxes on the line shafting in the mill are with Chapman double ball bearings, which renders it possible, even when some of the machinery is geared on, to turn the whole system by hand instead of employing perhaps 10 to 15 horsepower as would be ordinarily required. This does away with the labor of an oiler and is an example, everywhere visible, of the labor-saving devices generally employed in these reduction works. All rolls are duplicated in order to prevent delay in case of replacement of the roll shells. The capacity of the mill is 20 tons per hour.

The laying of the ores in the bedding bins permits of the proper admixture of ores which will flux, together with the addition in layers of the principal fluxes as may be required. A rail track runs along the bottom of the bin and the ore, in vertical sections, is shovelled into buckets which are immediately hooked on to an endless chain conveyed up an incline, automatically cutting off the power as they reach the top and running by gravity to the other end of the smelter, past the furnaces, to the Heberlein building. Here they dump their ore into a series of bins, pass on up an incline over a spring switch which sends them back to the bedding, bin doors, by means of yet another runway and spring switch at the far end.

From the second series of bins the ore is fed on to a belt, which carries it to an automatic mixer and thence it goes to a supply bin, whence it is taken either to the Heberlein roaster or converter as desired. The ore being roasted in the Heberlein roaster, a circular furnace having a diameter of 26 feet upon the hearth and a capacity of 55 tons, is passed out, slaked, taken up an elevator to a height above the Heberlein convertors, and is there fed automatically in the pots, each of which has a capacity of 12 to 15 tons each twelve hours. Here the product, ignition having been started by means of a small woodfire, is burned till the sulphur practically is entirely consumed, being subjected to an air blast. It has been found by experience that it is possible and, indeed, advantageous, occasionally to feed raw ore from the bedding bins into these convertors.

The mass coming out of the convertors is tipped to the floor below where it is broken up to a convenient size by the dropping of a weight from above, and thence is loaded through the floor into cars which run out over a similarly arranged switchback, as that noted on its passage from the bedding bins and return, having automatically dumped its contents into a bin alongside a C.P.R. siding. From this bin the product is taken to the other end of the smelter, dumped into a bin under the track, taken thence by a conveyor, and passed through sampling mill and crusher to a gravity tramway which takes it to a storage bin alongside the furnaces. Through this bin at the upper siding is passed those fluxes and ores which have not to be put through the Heberlein process and, hence, do not go through the bedding bins, but are fed raw into the furnaces.

As to the furnaces there is nothing novel as to their construction, beyond that they are each fitted with a Harris distributor, which has the effect of parting the flow of slag and matte, the one going out on one side of the distributor and the other on the other.

It will be perceived that the system employed is not only effective but greatly reduces the cost of handling a mixture of ores, coming mostly in small quantities. The mill and bedding bins were designed by Messrs. Hedley and Harris, the smelter manager and superintendent respectively who, together with the general manager, J. J. Campbell, are to be credited with the successful operation of this concern.

In connection with the Huntington-Heberlein process, there are many savings. The sulphur is entirely or nearly so, eliminated. It is taken out in far less time, far more perfectly, with less fuel and less labor than under the old methods. Handling is, therefore, not only cheaper, but faster. Moreover, there is another great economy, connected with the blast furnace. Under old conditions there was a certain quantity of sulphur in the charge which was troublesome to eliminate. This involved much cost and labor. Under the new method raw ore can be fed in just sufficient quantity to take up whatever copper might happen to be present in the charge in the blast furnace, and a matte of the requisite grade made at once or at worst in two operations. It is in these methods that the Hall mines smelter by making a better recovery of values while, at the same time, reducing the cost of that recovery, is meeting its rivals and is enabled to reduce by 20 per cent. its cost of treatment—or from $15 to $12. Further reductions can yet be made, but must wait upon an enlarged and steadier supply of ore, which in its turn hinges, though to a lesser degree, upon lower smelting charges.

SUNDRY GEOLOGICAL PROBLEMS.

By G. Henriksen, Inspector of Mines, Christiana.

On October the 1st, 1902, the writer sent a telegraphic report to the newspapers in Christiana *Morgenbladet*, *Aftenposten*, and *Verdens Gang* on "The Iron Ore Deposits in Sydvaranger, Finmarken, Norway, and Relative Geological Problems" which has since been reproduced in the Lake Superior number for August 27th, 1904, of the *Mining World*, Chicago, in *La Revue Noire*, Lille, for January 15th, 1905, in *L'Echo des Mines et de la Metallurgie*, Paris, for December 5th, 1904, in *Zeitschrift fur der Berg-Hutten- und Salinenwesen*, 1905, page 19-21, in *Engineering and Mining Journal*, New York, for February 24th, 1906, and in *Oesterreichische Zeitschrift fur Berg- und Huttenwesen*, No. 13, 1906. Referring to this report the writer wishes to submit the following as the conclusions from the geological observations which he has since then been able to make here in Norway:

The so-called Devonian sandstone at Krokkleven and Sundvolden, Ringerike, which has been deemed of the same horizon as the "Old Red" of the British Isles, is an igneous rock: it is the sheeted pendant of the superimposed chocolate colored rhombe-porphyry. Its "ripple marks" are curved-faced jointing planes. The conglomerate found about the transition point from porphyry to red sandstone also is an igneous rock. The "pebbles" partly can be recognized as crystals, imperfect and rough as they are and with rounded surfaces. They are also largely flattened, especially is this the case where the conglomerate shows rudimentary lamination. "Pebbles" flattened parallel to the lamination will then be found lying in rows along the bedding-planes. It may be that the red sandstone does not show exactly the same chemical composition as the porphyry; but this would not signify, because sheeted portions of eruptives usually differ in composition from adjacent and contemporary crystalline parts of the same. Thus for instance, quartz, calcspar, ores and carbon show a tendency to diffuse toward sheeted portions of igneous rocks and give them a composition different from the rest. Also sheeted zones of pressure are frequently "sericitized," "kaolinized" or "porphyritized." Conglomerates are often found on the boundary between the sheeted and crystalline facies of an eruptive, also marking the boundary between two systems of differentiated lamination at angles to each other. Hence the frequent occurrence of "bottom conglomerates." Each "pebble" of a conglomerate often is found to be the centre of concentrically sheeted matrix. Near Krokkleven I have found concentric pressure-zones in the porphyry enclosing blocks of porphyry looking like huge waterworn cobble stones. The lumps of crystalline gabbro at the Roros mines of cupiferous pyrites, between which gabbro and concentrically laminated eruptive the ore is usually found, have a smooth surface and the form of hogs-backs and potatoes.

At Sundvolden, Ringerlike, the same force which brought about the border-sheeting of the eruptive field of which the rhombe-porphyry is a part, has also been the occasion of the more or less differentiated lamination of the fossiiiferous sediments through which the eruptive has burst up, or rather the sediments have been differentiated and laminated through heat and lateral pressure from the eruptive and at the same time the border-zone of the eruptive has become sheeted by the reaction. The cooling effect from the sediments together with the raising of the melting point of the eruptive border through reactive pressure from the sediments, have combined to accelerate the solidifying of the eruptive border, thereby causing the fine grained more or less clastic structure of the same and its bedded state vertically to the direction of the reactive pressure. The igneous "sandstone" and the silurian sediments are now found conformably "stratified" and are gradually merging one into the other, and both are dipping under the rhombe-porphyry. The jointage of the granite at Eidanger, near Porsgrund, is conformable to the "stratification" of the adjacent Silurian, and they gradually merge one into the other, partly because the jointing of the granite is accompanied by closer grain, partly because the sediments adjoining the granite have been in a state of fluidity increasing with the proximity to the molten granite. Such a process of differentiated sheeting of sediments largely resembles the analogous differentiated lamination of igneous rocks. Sediments in a half molten and igneous rocks in a half cooled state under peculiar conditions of pressure will behave alike. Special conditions of heat and pressure will put sediments in a state of fluidity sufficient to allow of a very extensive rearrangement of substance, at the same time as they remain solid enough to prevent all traces of organic life from being obliterated. By strong and regular differentiated sheeting of sediments the fossils contained are largely obliterated; certain of the beds formed by the lamination are comparatively intact and show the fossils well; other beds formed by the lamination of sediments under heat and pressure have been entirely liquified and appear, as if they were actually constituted of originally igneous matter. The first stage of the differentiated lamination of calcareous fossiliferous sediments, as at Ringerike, gives them a certain nodular structure, in the next stage they show lenticular lime-balls in regular rows, in the next stage the marl-balls have as it were coagulated into bands of calciferous matter, in the next stage these bands of hard calciferous matter are very thick and well defined and have as their complement proportionally wide series of thin shale. The original sediments will be found relatively intact under certain conditions of several crossing directions of lamination. Thus, for instance, I found near Sundvolden three crossing systems of lamination enclosing a wedge of sediments with fossils relatively very well preserved. As an analogy, I may mention that at Lottivara and Lemmivara, in Laxely in Finmarken, at numerous places right in the middle of hornblende schist three crossing directions of jointage are found to enclose a pyramid with the point down, consisting of crystalline gabbro often carrying in the middle of it a lump of native copper weighing half a pound, and such wedges of gabbro would be found in quite isolated positions here and there in the hornblende-schist. Where such nearly unaltered portions of relatively calcareous, fossiliferous matter were found, they showed the original fossiliferous sediment to have been an amorphous mass without any stratification and consisting of corals and shells of other marine animals imbedded in a mud. Where pure fossiliferous limestone is now found, it is partly made up of

The Hall Mine Smelter.

The Heberlein Converters, Hall Mines.

the original fossils in situ, but the balance of the lime has come there by replacement. That replacement of substance can take place to a very large extent without obliterating the fossils contained in the sediment can be seen at the hematite mines at Clinton in New York State: in the so-called fossil ores the fossils as well as the mud in which they have been imbedded have all been turned into hematite ore. Similar instances can be had from the hematite deposits in Cumberland, where brachyopods and corals have been converted into hematite retaining their form. In Konerudkollen zinc mines near Drammen one finds corals filled with crystals of idocrase. Ore deposis are largely formed by diffusion and migration of igneous emanations of metalliferous matter having taken place within the sediments adjacent to an eruptive, according to laws analogous to those obtaining for the segregation of ores within eruptives. Thus effects of pressure play a similar role also for ore deposits in sediments. The sediments have been able to get into a state sufficiently fluid to allow of the migration of metalliferous particles, but not sufficiently fluid to obliterate all the fossils.

The "post-silurian" eruptives of the Christiania district, geologically speaking, have their porphyritic rim and their border sheeting, in red sandstones as at Krokkleven and Holmestrand or in dark hornblendic slate as at Krekling, Eker. The sediments of the Christiania territory having been differentiated and laminated through the agency of heat and pressure from the very large "post-silurian" field have afterwards been altered into alum shale in the regions nearest to the "Archean" under the influence of heat and pressure from the latter (the Archean), which is of igneous and comparatively recent origin. The "Archean" has partly altered the previously laminated "silurian" sediments nearest to it into alum shale, partly it has melted these sediments forming the so-called Oslo porphyry (formerly also called oligoclase-porphyry, eurite porphyry or felsite porphyry). The fossiliferous ellipsoides of "stink-kalk" contained in the alum shale have got their ellipsoidic form and their contents of bitumen, hydro-carbon, through the eruptive action of the "Archean" upon limestone beds previously existing. The same action of the "Archean" accounts for the carbon contents of the alum shale, the bitumen of the lime ellipsoides being volcanic products diffused from the magma of the "Archean." Alum shale and Oslo porphyry are often found to merge one into the other. At Vikesund, Modum, the Oslo porphyry stands up in the alum shale as a wall parallel to the boundary plane between the alum-shale and the "archean." The conglomerate at Fure north of Vikesund is found forming the transition between the eruptive "archean" and the sedimentary alum shale. This conglomerate at Fure is one of the most remarkable geological occurrences in Norway.

The most striking instance of differentiation and lamination of igneous rocks through effects of pressure in cooling that I know of is the so-called Ottfjall diabase from the Ottfjall Mountain in Jamtland, Sweden, and described by Professor P. E. Holmqvist in the transactions of the geological society of Stockholm, vol. 16, (for 1894, page 175). The sandstone formation of Dalecarlia consists of sandstones, conglomerate, and "intrusive" diabase beds. All these rocks are igneous, and the formation is a product of the differentiation lamination of a cooling magma through pressure, such as has been the case by the above mentioned Ottfjall diabase. Certain beds formed by the differentiation and lamination of the Christiania sediments have become melted in the process and are now found as layers of diabase following the stratification of the sediments and merging by imperceptible gradations into the same.

Sheets of molten rock which have been considered as intrusive eruptives are found all over the world as one of the products of the differentiation and lamination of sediments through heat and pressure from eruptives of the neighbourhood. As instances can be given: the toadstone of the Derbyshire lead mines, the celebrated Whin Sill in the North of England, the diabase beds in the iron mines of Pervukhina in Southern Ural, Russia, the younger "Schalstein" and diabase-amygdaloid of the Buchenberge iron mines near Elbingerode, Harz, the grey porphyry at White Cap Chute, Leadville, Colorado, the porphyry of the Eagle River mines, Eagle County, Colorado, the Eagle Hill porphyry at Mercur, Utah, the Leadville white porphyry, the white porphyry of the London mine in Mosquito gulch in Colorado, the "white porphyry" (diorite) on Aspen Mountain, Colorado.

The results of the borings for coal at Andoen in Nordland go to show that the Tromso marble-mica-schist-group or the "Archean," or whatever it would be called, of this part of Norway is younger than Brown Jura. The bitumen forming the chief constituent of the coal found there is an igneous emanation from the eruptive below.

Good mines are proverbially watery. This is easily explained, because ores have had a general tendency to diffund to zones or localities of stress, pressure, jointing, shearing and shattering within eruptives or adjacent sediments. "Lettengange" often carry ore. Both genuine "Erzgange" and pyrites deposits of the Vigsnaes type very often have "gouge," "selvage," "gangletten," "salbander" accompanying the ore, which is one fact to indicate the common genetic origin of "erzgange" and lenticular deposits of pyrites as found at Vigsnaes and many other places. At Rodklev mine (situated about one kilometer from old Vigsnaes mine) going through one of the crosscuts worked vertically on the "stratification" one can step by step follow the saussurite gabbro, passing by imperceptible gradations through foliated fine-grained gabbro and green chlorite schist to clayey matter, "Gangthonschiefer," in lenticularly shaped inclusions within the green schist. The normal crystalline saussurite gabbro has little or no regular jointing; as regular jointing comes in, the minerals of the gabbro get a certain orientation parallel to the jointing; as the jointing planes get closer and closer, the foliated gabbro gradually passes into green chlorite-schist, and by very strong and close lamination the chlorite-schist gradually passes into fat clayey matter. Thus this clay is, at it were, the final stage of laminated saussurite gabbro. Jointing planes are a product of contraction by the solidifying of a molten magma. Where such solidification is precipitated by stresses, jointing vertically to the direction of the pressure will be the result, also finer grain and a certain more or less pronounced orientation, parallel to the jointing, of the crystals formed. Clastic structure also often is found as the result of solidification precipitated through strains and stresses. Jointage and related phenomena are common in sedimentary as in igneous rocks, which shows that contraction has taken place also by the passing of the first-mentioned from the semifluid into the solid state.

Ores are preferably found in pressure-zones, because metals have a tendency to diffuse towards the portions of a magma that consolidate first.

The Christiania Valley is traversed by an extensive system of diabase dykes running NW.—SE. These dykes are not originally igneous, consisting of molten matter from the sediments and being formed through the agency of pressure-forces ("Druckkrafte") acting normally to the strike of the sedimentary "strata." The "dykes" of diabase locally called blabest at Konerudkollen zinc mines near Drammen are of sedimentary origin, the Silurian having been partly melted by heat from the underlying granite in zones with peculiar conditions of stress or pressure. These same conditions have also tended to favor the deposition of ore diffusing from the underlying "post-silurian" granite into the "Silurian" floating on the top of the granite. The rhombe-porphyry at Tyveholmen in Christiania also is melted sediment.

Concentrically laminated portions of foliated eruptives usually are found to enclose very heterogenous masses of rocks of extraordinary composition: pegmatite, ores, dolomite, conglomerates, etc. Instances are: The iron deposits on Lango Island by Kragero, the norite field by Ertelien, Ringerike, with its contents of nickeliferous pyrhotite, the Storgrufva mine at Persberg, Sweden, Ammeberg zinc-mines in Sweden, Pitkaranta in Finland, Gap nickel mine, Lancaster County, Pennsylvania. The Sudbury nickel district in Ontario, Canada, offers an instance of concentric lamination of eruptives on a colossal scale. The elliptic or perhaps ellipsoidal lamination here encloses a so-called Cambrian field of peculiar rocks that have been called vitrophyre tuffs, gray clayey sandstones and black slates. In the black slates are found irregular veins of anthraxolite. Somewhat similar geological conditions as in the Sudbury district, although everything is on a much smaller scale, obtain by the Langsev—Thorbjornsbo iron-ore field at Arendal, Norway. See. *Nyt Magazin for Naturvidenskaberne*, volume 11, for 1861.

Nickeliferous pyrhotite is often found in the company of norite; but the nickel ore at Ertelien, Ringerite, has no more been magmatically segregated out of the norite, than gold has been magmatically segregated out of the quartz of a gold-quartz-vein. Still less are the Sudbury nickel deposits segregated out of the occurrences accompanying them of norite which are often very small.

Semicircular lamination of eruptives and sedimentary rocks equally with concentric lamination has favored ore deposition. It seems as if the forces at work to cause irregularities in the differentiatory lamination have served also to attract ores to their locus of activity. As instances of ore segregations accompanying semi-circular or irregular lamination can be given: The Dunderland iron ore deposits, Witwatersrand banket i Transvaal, the Marquette iron ore mines Lake Superior, Schmiedefeld iron mines near Grafenthal in Thuringia, Eise nerz iron mines in Austria, the saddle reefs of Bendigo, Australia, Broken Hill, New South Wales, Rammelsberg by Goslar, Harz, the pyrites mine at Meggen on the Lenne, Germany, Paulus iron mine at Moravicza, Hungary, Low Moor iron mine, Virginia, Cherry Valley mine, Missouri, Franklin Furnace zinc mine, New Jersey.

At the Fehn iron mines, near Ulefos, the dolomite is found to pass into granite by transitional stages showing all gradations. The limestone called Hedekalk in Sweden and Biridkalk in Norway are also of igneous origin. By the differentiatory lamination of sediments they have largely been charged with foreign substance which emanating from the active eruptive has been deposited in the sedimentary so-called "strata" by replacement, or whatever one would call a process which evidently has much in common with the processes of magmatic segregation and rearrangement of substance which are observed to have taken place within igneous rocks. While sedimentary limestone beds will partly have got the lime from fossils in situ and from lime of organic origin concentrated into the limestone beds from other parts of the sediment dolomite is an igneous product, diffused into the sediments from the eruptive, settling there by replacement; so also is the greater part of the carbonic substance constituting the coal-seams. Only part of the carbon in the coal-seams is of organic origin, the rest has come from the nearest eruptive wandering into the sediments and has settled there according to laws which are, at least at present, hard to understand. The fire-clay following the coal seams give one indication of their genetic origin, same as " Gangletten," gouge and kaolin afford one indication of the ordinary genetic origin of ore deposits. If the coal in the coal-seams is largely an emanation from eruptives, it follows naturally that petroleum and natural gas must also be volcanic emanations.

The copper bearing shales of Mansfeld have been formed genetically on somewhat the same lines as a coal seam (they also contain carbon, the copper having diffused into the sediments, from the nearest underlying eruptive. (Such diffusion is not entirely inexplicable on everyday actual experience. In two pieces of two different metals in close contact metallic substance will sometimes diffuse from one piece into the other at ordinary temperature, when sufficient time is allowed for the process.) At Mansfeld also cross-pressure indicated by the system of strong joints locally called " Rucken " is found to have influenced ore deposition. However, it is not sure that the systems of cross-jointing so common in coal-mines has not also influenced the deposition of carbon.

Most of the ore deposits of the world owe their existence to eruptives. They are, with few exceptions, either found as segregations within eruptives or as emanations from such eruptives deposited in neighboring sediments.

By the differentiatory lamination of sediments the fossils contained in the same sediment have had variable fates according to their different chemical compositions and to the special kind of replacement which has taken place at the particular spot where each fossil has been located. Some of the "strata" produced have become melted. In these " strata " and many others the fossils have been entirely obliterated. Lime-shells have fared the best in zones of calcareous replacement, also they have fared well in localities of iron-ore replacement. Parts of plants have had the best chances of preservation in the zones of carbonaceous replacement, that is to say, in the coal seams. On the other hand, it seems likely that the carbon of volcanic origin has had a tendency to diffund towards localities which have already been rich in vegetable matter, thereby making the frequency of fossil plants in the coal-seams more pronounced. Fossil wood often is found in a state of good preservation by silicious replacement. In the Leeds mine, near the South East corner of Nevada, horn-silver has diffused into and impregnated vegetable remains such as wood, twigs and leaves. The nature of the fauna and the flora as found in a sedimentary " stratum " is then chiefly determined by purely accidental circumstances, and the historical part of geology, palaeontology, and palaeobotany has to be revised.

The position of the small remnants of fossiliferous sediments that have escaped the universal destruction occasioned by the eruptive upheavals that have made Fennoscandia goes to show that this gigantic volcanic activity has taken place in stages, and that the outburst of the " Archean " marks the last stage of this activity. The Thelemarken formation represents the surface development and the Bamble formation the border facies of the great " Archean " eruptive field, and they are both highly differentiated, same as the Huronian and Algonkian facies of the great " Archean " eruptive field of tertiary age in Canada.

It has been remarked that the Great Lakes have been the making of the United States. If that is so, it is the sheeting of the border of the large Northern American " Archean " eruptive field in contact with equally sheeted adjacent sediments which has been the making of the Great Lakes. Also the sea between Jutland and Norway, the Gulf of Finland, Lake Ladoga, Lake Onega and the White Sea owe their existence to the sheeted, by erosion easily destructible, condition of the border of the Fennoscandian " Archean " in contact with equally strongly sheeted sediments.

Some of the richest mines in the United States. the Lake Superior iron mines and the Lake Superior copper mines, are found about the contact of the great North American eruptive " Archean " field with the sediments to the South of it.

The Alps and the Himalayas have been formed by the eruption of the " Archean " in the tertiary age.

THE COBALT MINING DISTRICT.*

Dr. Robert Bell.

This district has an area of about fifteen square miles and is situated on the line of the Timiskaming & Northern Ontario Railway, its centre being three or four miles west of the northern part of Lake Timiskaming on the Ottawa River. Its surface is undulating, partly rocky and partly drift covered, and is well wooded. On the large scale, it has a generally even aspect and is interspersed with numerous small lakes.

The rocks of the district in general, provisionally classified with the sub-Huronian or Keewatin series, are mostly of igneous origin, consisting of granites, greenstones, agglomerates, volcanic tuffs, etc., and are favorable to the occurrence of metallic ores, should any veins exist among them. It was, therefore, considered to be only a matter of time in the evolution of the country from a state of wilderness, when important deposits of ores would be discovered anywhere among these rocks.

To the southward of the igneous rocks of the Cobalt district, quartzites, crystalline schists, etc., of Huronian age occur around Lake Temagami and

* From the Summary Report of the Geological Survey Department of Canada for 1905.

southward, and still farther south quartzites of the same series, while still farther, in the same direction, several varieties of Laurentian gneiss are developed all the way to Lake Nipissing. To the northward of Cobalt, one large and several smaller inliers of unaltered, horizontal fossiliferous limestone of Niagara age rest upon the igneous and metamorphic series.

In 1887 and subsequent years, the writer made a geological reconnaissance of the region around Lakes Timiskaming and Temagami and westward. In November, 1905, and again in April, 1906, he visited the Cobalt mining district for the purpose of studying the rocks of this particular area and the modes of occurrence of the ores associated with them.

Native silver and its associated minerals were discovered early in the summer of 1903 by Messrs. McKinley and Darragh, at the southwest extremity of what is now called Cobalt Lake. These men were then engaged in taking out ties for the new railway under construction. Having had some experience in prospecting, one of them, in breaking the rock at the southern angle of the lake, close to the right-of-way, discovered small pieces of a white metal embedded in it. On removing the moss and black loam in the vicinity, numerous small thin blackened plates of this metal were found. About the same time, native silver was recognized in a vein at the northeast end of Cobalt Lake and some large and small rough blackened nuggets of the same metal were washed out of the earth on the outcrop of the vein. The construction of the railway was, therefore, the direct means of making the discovery of what is turning out to be an important mineral district. The "finds" above mentioned, however, attracted but little notice, as the men who made them were directing their attention to the discovery of copper ore and not thinking of silver, none of which had previously been found in this part of Canada, and they were not impressed with the possible significance of what they had found.

In November of the same year, the attention of Prof. W. G. Miller, Provincial Geologist of Ontario, was called to this discovery and he paid a visit to the locality, returning with specimens of the silver and its associated ores. As these had been found in only two or three spots at that time, Prof. Miller could not forsee the numerous discoveries, over a considerable area, which have since been made, but he thought that the prospect already located was distinctly promising.

I considered the discovery sufficiently important to have it thoroughly investigated by the Geological Survey, and accordingly I engaged Prof. Parks, of Toronto University, to undertake the work immediately on the close of his college duties the following spring. In the meantime, the Ontario Government had sent Prof. Miller to the same ground very early in the season, (about the beginning of March). After Prof. Parks had worked for some time on the same ground as Prof. Miller, the latter proposed a division of their operations, so as to avoid duplication. As it appeared that the silver-bearing district might extend a considerable distance to the northward, he suggested that Prof. Parks should explore in that direction, while he himself would operate to the southward.

At the present time, openings, showing more or less native silver, have been made in probably nearly a hundred different spots within the fifteen square miles above mentioned as comprising the productive silver district of Cobalt. With few exceptions, these openings have been made in what is locally called a "conglomerate," but which is more properly an agglomerate, containing numerous irregularly distributed angular and rounded fragments, mostly of gray, and red granite, and of the porphyrite itself in a somewhat soft bluish and greenish gray matrix of hornblende porphyrite or porphyritic tuff. The fragments are seldom large, and they are generally very irregularly distributed, partly in bunches, but in other parts they are sparsely disseminated.

The agglomerate has a general horizontal aspect, but there appears to be little or no evidence of aqueous stratification in the agglomerate itself, or of the action of water in the arrangement of the fragments, which are scattered through the mass at all angles. The weathered surfaces have the character and appearance of a volcanic rock and not of a conglomerate. The fragmental character of this rock prevails at the surface throughout most of the silver-bearing area, but, in the deepest workings, it shows a tendency to become non-fragmental. The colors of fresh fractures are generally bluish and greenish gray, but at some localities the color is a dirty drab and, on close inspection, this shows a mottled character of lighter and darker shades. It is doubtful if this agglomerate is equivalent to either the Lower or Upper slate conglomerate of the Huronian system north of the St. Mary River.

At some places in the district, the agglomerate passes into or includes fine grained gray or drab slaty rock, and at others gray arkose or greywacke, grading into a variety of impure quartzite. The total thickness of these rocks has not been ascertained. At the Larose mine, the upper stratum consists of about twenty-five feet of the fragmental agglomerate, underlain by an equal thickness of gray slate, which together form a cliff fifty feet high. The surface then slopes down from the foot of the cliff for thirty or forty feet to the collar of the shaft, which has been sunk on a group of small silver-bearing veins, separated from one another by the country-rock, and having an average width of four or five feet. At the time of my visit last November, this shaft had been sunk through the agglomerate to a depth of ninety feet, and a drift run for about 100 feet to the northeast and 350 feet to the southwest. The country-rock on either side of the vein was seen to carry metallic silver at many places throughout this length. At one point to the southwestward of the shaft, the vein-group bulges to a width of about twelve feet and shows distinct parallel veins in the roof of the drift. Within fifty feet of the southwestern extremity of the workings, at that date, the vein divided into two branches, both of which were rich in silver. During the winter the shaft was continued to a depth of 205 feet from the collar to the bottom of the sump, and at 200 feet, a tunnel was driven forty feet N.E. and 50 feet S.W. from the shaft. A winze was also sunk from the 90 to the 200 feet level, at a distance of 150 feet from the shaft. In the 200 feet level are two veins of calcite, separated by dark slaty country rock. This latter as well as the veins, is rich in native silver in the form of plates and rough nuggets. The rock breaks into lumpy schist-like fragments with smooth surfaces showing numerous thin leaves and scales of native silver on a large proportion of them.

Both the natural exposures and the artificial openings show that the agglomerate formation is divided into approximately rectangular blocks by two sets of dry vertical joints. Lines of fissure follow the courses of some of those joints and along those the mineralized veins occur. Their gangue consists of calcite. Sections of the veins are sometimes completely filled by metallic ores, especially smaltite or diarsenide of cobalt.

With the agglomerate and slate ash series, above described, are associated arkose or greywacke, quartzite and crystalline diabase. The slaty ash rock is not identical with true or argillaceous slate, but consists of the finer material derived from the modification by water of ashes and other volcanic materials, which became broken up and assorted when they came under the influence of the primeval sea. They are generally dark-colored and obscurely banded parallel to the horizontal cleavage. In the country to the westward of the Cobalt district, along the Montreal River, around Lady Evelyn Lake, etc., it is a common thing to see alternations of strata of considerable thickness, consisting of quartzites, arkose and this slate-like rock, which have evidently been separated by water from the volcanic materials that were being produced in abundance at that period of the earth's history and assorted into separate deposits of the coarser and finer materials.

The thickness of the agglomerate and slates, tuff or porphyrite probably varies considerably. At the Larose mine these rocks have a known depth of at least 295 feet, made up as follows: Upper half of the cliff above the mine, 25 feet of agglomerate; lower half of cliff, 25 feet of slates; slope from foot of cliff to collar of shaft, agglomerate about 40 feet; same rock to first level, 90 feet; from first level to bottom of sump, porphyrite tuff, 115 feet.

Along some of the joint-planes of either of the sets already mentioned as traversing the agglomerate, a disturbance accompanied by fissuring has occurred and these constitute the broken-up veins carrying the silver· and other metals. It was observed that the stronger joints with slicken-sided walls often run in pairs close together. with a silver-bearing calcite vein in one or both of them. These joint-veins sometimes curve round through considerable angles up to 90° and they also give off branches. Examples of this may be seen at Little mine, from which a greater quantity of silver is said to have been extracted than from any other opening in the district. Some branching cracks, only about a quarter of an inch wide, filled with a fine red earth, run from one of the veins into the wall rock. This red earth was found to be very rich in silver, although no visible grains of the metal, or of any of its compounds, could be detected by washing it.

On the same vein which runs N. 23° W., a shaft has been sunk to a depth of 106 feet, from which a cross-cut has been made for 60 feet east and 70 feet west. The rocks cut by the shaft are blue agglomerate at the surface, followed by bright gray arkose, approaching quartzite, with an occasional rounded fragment of granite. Below this is the slaty rock which, on weathering, shows dull lines of stratification. Its color is from dark bluish and greenish gray to nearly black.

Horizontal thrusts, dislocating the veins from two to ten feet, have occurred in some places. Examples of these may be seen at Little mine, Cobalt Hill mine and in the tunnel into the cliff just above the Larose mine.

A considerable portion of the eastern part of the Cobalt district is occupied by dark greenish-gray crystalline diabase in proximity to the agglomerate. In places this greenstone is probably intruded as dikes and masses in the agglomerate and its associated rocks; while in others it may occur as sills or overflows, lying in or upon these rocks.

Silver-bearing calcite veins, which also carry smaltite and resemble those in the agglomerate in some other respects, traverse the diabase at several localities in the district. Veins of this character occur on the following properties:—Violet or Handy, Welsh and Giles (north of the Foster mine), the Jacobs mine, the Hargraves, or McMillan, (south of the Jacobs). Diabase also occurs at the Watts or W. A. Allan mine. The Ben mine on the shores of Lake Timiskaming, now owned by Mr. Hotchkiss and associates, is in the agglomerate, but a greenstone rock occurs not far from it.

The majority of discoveries of silver, so far made in the Cobalt district, occur along lines running about northeast and southwest. But there is another set of veins crossing this course nearly at right angles. Two veins of this set traverse the property of the Larose Mining Company, the more northeasterly of which has been worked by running a tunnel along the vein into the cliff which rises a short distance to the south-eastward of the shaft. The other cross vein outcrops on the flat top of the hill at about 200 yards to the southwestward of the last. Here the earth has been removed so as to expose the glaciated surface of the agglomerate. In one part of the smoothed surface, the vein shows itself as a reticulated shining streak of polished silver and rock, three or four inches wide. A neighbouring part of this vein has been opened and a considerable quantity of rich ore removed.

The silver-bearing veins of the agglomerate throughout the district are themselves small, but since much of the ore is derived from the branch veins and the country rock adjoining them, they are more important than might be supposed at first sight. The gangue consists of calcite, derived from the agglomerate, with rarely a little quartz. The vein-matter is generally much split up, fractured, faulted and brecciated and many miniature horses are included. Branches are sent off, which often follow the secondary dislocations accompanying the main disturbance that caused the vein. Yet there is usually a continuity of productiveness along the general plane of fracture. On either side of this broken-up and interrupted plane the wall-rock on either side may contain much native silver in the form of plates, sheets and leaves, filling small fissures or gashes.

The values are mostly in the silver, all the other ores being worth comparatively little. From the information I could gather as to the output of the different mines, the total value of the silver produced in the district, from the time the first openings were made until the beginning of April of the present year, amounts to upwards of $1,500,000 and it may approach, but does not exceed, $2,000,000.

The following twelve metals have been found in the veins above described:—Silver, cobalt, nickel, copper, lead, arsenic, antimony, bismuth, iron, manganese, zinc and, lastly, gold in small quantity in one or two instances. Most of these metals have here entered into numerous combinations, among themselves and with sulphur and oxygen, to form a variety of somewhat uncommon mineral species.

The presence of such a number of different metals is a hopeful sign and one of the proofs that the containing rocks are essentially of igneous origin, notwithstanding the local modification of parts of them by water.

For convenience, I use the word "mine" in the same sense as do the prospectors of Cobalt, namely, to indicate any artificial opening in the rock, such as a shaft, an open cut, etc., instead of restricting it to its true meaning.

The silver and the ores of the other metals usually occur irregularly in bunches or scattered through the calcite and also through the country rock between the small veins of the groups, as well as for some distance inward from the walls. Most of the metallic silver is found in flat plates with extremely ragged and irregular edges, which, judging from a parcel of 150 or 200 pounds in the office of the Nipissing Mining Company, will weigh, on an average, from one-quarter to one-half pound each. In the open cut, called No. 26, on this company's property, I saw, at a depth of 30 feet, a vein of coarse crystallized calcite 4 inches wide, thickly studded with bright silver to the extent of fully 20 per cent. of its weight. Only 4 feet in height as rich as this was exposed, but it passed into the rock below maintaining its width and value. A specimen of this vein weighing 130 pounds was taken to the company's office. Specimens of pure silver, weighing from a few pounds up to twenty or more, have been obtained in a number of the mines and several pieces rich enough to be called "nuggets" have been found. A piece of rich ore, 5 inches thick and weighing 258 pounds, was found in the surface debris lying upon the outcrop of the Larose vein on the west side of the shaft. It originally formed a part of the full width of one "rib" of the vein and has a somewhat laminated structure, the layers being composed of smaltite, niccolite, native silver and calcite. This specimen was purchased for the Museum of the Geological Survey and, in order to ascertain the value of its silver content, five holes were bored through it. The drillings from these, on analyses, were found to contain about 18 per cent. of silver. The high specific gravity of the smaltite and niccolite gave rise to a belief that this "nugget" might contain a larger percentage of silver. A mass of calcite and silver, said to weigh about 700 pounds, taken out of the Larose mine, was described as being so strongly held together by the silver as to require the use of cold chisels to cut it into pieces of convenient size to ship. "Nuggets" of mixed silver and calcite, weighing upwards of 100 pounds, are exhibited in the banks at Cobalt and in some of the mining companies' offices in the district.

As a striking example of the numbers of heavy pieces of native silver which may be picked out of the ore after it has passed through the crusher, I may mention that Mr. W. H. Linney, Superintendent for the Nipissing Mining Company, informed me that last year he had made a shipment to Mr. Ellis P. Earle, 31 Nassau street, New York, one of the partners in this company, of a petroleum cask containing 3,977 ounces of metallic silver and a large mass of niccolite with native silver protruding from it on all sides, and which was afterwards found to contain 780 ounces of this metal. The value of all, at 60 cents per ounce, was $2,854. At the offices of nearly all the mines in the district, the visitor is shown numbers of heavy pieces of native silver taken out of the respective mines.

The concentration of the silver in the metallic form near the present surface or at a moderate depth has no doubt been due to a chemical or electro-chemical process during a considerable period in former geological times, by which compounds of silver were reduced and deposited in their present form. It is not, therefore, to be expected that such heavy native silver will continue to any great depth. In the deepest parts of the Larose mine, 200 feet from the surface, a notable increase in the proportion of argentite has already taken place, dark red silver (pyrargyrite) has made its appearance and the changes due to surface influences in the wall rocks, gangue and ores, are less noticeable, as all these have assumed a firmer and fresher appearance.

The following notes on some of the individual mines of the Cobalt district are partly from personal examination and partly from descriptions given me by reliable persons, mostly the agents or the original owners of the properties. Up to the beginning of April, about forty different properties had been or were being worked. With three exceptions the depth attained was less than 100 feet, and in most cases it did not exceed 30 feet. At the Larose mine, the shaft (including sump) was 205 feet deep; at the Trethewey mine (J.B. 6), 100 feet, and at Little mine 106 feet. The company which has, so far, produced most silver is the Nipissing, which owns 900 acres of mining land to the southeast of Cobalt Lake. Its mining operations have, as yet, been confined to one lot—RL 404—comprising only 10 per cent. of the whole, but which includes the Cobalt Hill mine on its north side and Little mine in its southwest corner. Twenty-five other separate openings have been made on this lot, all in agglomerate rock. They have been numbered in the order in which work was commenced upon them, and more or less silver has been extracted from each. Only three of these openings exceed 30 feet in depth. According to the records in the books in the local office of the company, these workings have produced, since operations began in 1904, silver, with a small proportion of other metals, to the value of $1,045,000, of which about $145,000 worth is still in the storehouse at the mines.

From Little mine, a shipment of 20 tons was sent to market a year ago. It assayed 4,800 ounces per ton. At 60 cents per ounce this amounted to $57,600 and was the best car-load which has yet been exported from the Nipissing Company's mines.

At the working on the company's property, called No. 19, there is an open cut 50 feet deep and about 200 feet long with a breadth of 6 or 7 feet. It is said that out of this cutting 200 tons of ore were taken, worth $1,200 a ton or a total of $240,000, which is more than has been produced by any other single opening in the district.

In the southeastern part of Lot R. L. 404, and close to the shore of Petersons Lake, are situated the open cuts called Nos. 12, 13, 15 and 21, at two of which work was going on at the time of my visit. Very rich ore has been found in No. 12, and the superintendent stated that $25,000 worth of silver had been taken out of it; also that some of the dressed ore of No. 13 assayed as high as 3,500 ounces per ton, and none less than 2,500 ounces.

Three car-loads of 30 tons each, or 90 tons in all, of cobalt and nickel ore were reported as having been sent last year from the Cobalt Hill mine. The company received almost nothing for the nickel and arsenic contained in the ore. It was rather a singular fact that this ore contained less than half an ounce of silver to the ton. From the same mine, in 1904, the Nipissing Company's books show that 397,310 pounds of smaltite, containing only 5½ ounces of silver to the ton, were sent to New York. The heaviest single mass of cobalt ore found upon the Nipissing Company's land was in No. 8 open cut, which about 100 feet long and runs about east and west. From this opening 132,000 pounds of cobalt ore, containing 10 per cent. of the metal, were taken out. One large slab of solid smaltite was removed which was 16 inches in thickness and weighed over two tons. In this cutting, great quantities of cobalt bloom were uncovered along the south wall. The laborers threw it out in shovelfuls, in the form of a plastic mass.

The workings known as the Trethewey mines are situated on lots J.B. 7 and J.B. 6. Silver was discovered by Mr. W. G. Trethewey on both of these lots on the same day, 23rd May, 1904. The more northern lot, J.B. 7, which belongs to Mr. Trethewey personally, is called the New Ontario mine. The principal vein on this location is 8 inches wide and runs nearly east and west. A shaft was sunk upon it to a depth of 70 feet. On driving eastward at this depth, the vein soon forked. The drift was continued 40 feet on the northern and 190 feet on the southern division. This again split up into branch veins comprised in a breadth of 7 or 8 feet, between which the wall-rock was well charged with silver, and the small branches were also "shot through" with the native metal. After much work had been done on the south fork, an experimental break was made into its southern wall and after crosscutting only four feet a larger vein than the one being worked was struck, which materially increased the output. A good deal of stoping was done on the small veins and adjoining rock, and prior to November, 1905, 44 tons of ore which had been taken from these workings had been sent to New York in two cars and sold for $110,000. Two other car loads of lower grade ore were also sent. Immediately adjacent to the veins, the wall-rock holds sheets or plates and nuggets of silver. One of the former had a superficies of about 25 square inches. Some small boulders of granite, about the size of a man's head, taken out of the agglomerate had been fractured *in situ* and were penetrated by veins or sheets of native silver. The gangue of all the veins here is calcite and, besides the native silver, it holds smaltite and niccolite.

Captain Reddington, in charge of these properties, informed me on the 13th of April, 1906, that since last November, two car loads of ore had been sent to New York, one consisting of 28 tons of rich material, which sold for $68,000. The second car carried about 30 tons, but he had not, at that date, received the return for it. These shipments, together with some ore on hand at the mine will, it is said, make a total yield, so far, of about $200,000.

On lot J.B. 6, immediately adjoining, to the south, the property last described, seven silver-bearing veins have been discovered, all of which run nearly east and west. On vein No. 1, where the initial discovery was made at the time the claim was staked, a shaft has been sunk to a depth of 100 feet at a point 200 feet southeast of the 70 feet shaft above described on J.B. 7. From the bottom of this shaft a drift has been run 60 feet east and 40 feet west following the vein. The latter consists of a group of stringers, all much broken up and mixed with the wall-rock. Sometimes there is a streak of vein-matter on one or both sides of this group. Native silver, in the form of bright leaves, occurs in the rock among the stringers, but most of the metal is found in the walls adjoiing them. Open cuts have been made on the other six small veins and native silver has been found in all of them in the form of large disseminated grains, which sometimes occur in considerable bunches. The largest of these open cuts is 50 feet south of the above shaft and is 70 feet long by 30 feet deep. The country-rock at the openings on both J.B. 7 and J.B. 6 consists of a blue-gray, soft, fine-grained or amorphous tufa, which, towards the surface, holds rounded and angular fragments of volcanic ash-rock and of gray granite.

Among other openings visited in this part of the district, were the Timiskaming and Hudson Bay and the McKinley and Darragh mines. The last named has been already mentioned as the site of the first discovery of silver in the district. Only a small amount of work had been done on this property, but an opening which had been made on a vein at the water's edge in the southern angle of the lake, showed a promising amount of native silver, together with some smaltite.

At the Timiskaming and Hudson Bay Company's mine the silver-bearing vein which was worked runs northeasterly and is four inches wide, with silver also in the walls. I was informed that here a stope, only 30 feet long and 25 feet high, had yielded two car loads of ore, which sold in New York for $32,500 and $7,000 respectively.

The Jacob's mine, already mentioned, lying to the southeast of Petersons Lake, affords one of the best examples of a silver bearing vein cutting the dark greenish-gray crystalline diabase of the district. The vein, which is of calcite, runs north and may be seen along the west side of an adit which has been driven 120 feet on its course into the side of a hill. At first the vein is only two or three inches wide, but in advancing into the adit it is seen to increase to four and eight inches, and in one part, where it is split up and brecciated, it has a width of ten inches and holds bunches of native silver. In another part also the vein was observed to be rich in the metal. Higher up the hill, an open cut has been made along the same vein with a depth of 25 feet, for a distance of 70 feet, from which it is continued on the adjoining White-Hargraves property. Smaltite and a mineral like niccolite also occur along this vein.

The captain in charge informed me that 23 tons of ore, containing about 3,000 ounces of silver to the ton, besides a little cobalt, nickel and arsenic, had been shipped from the mine during the present spring; also that last year two car loads of ore had been sent from this vein and three from another one, which had been previously opened on the property.

Mr. Henry Richardson, manager of the McLeod and Glendenning (or Hanson) mine, informed me that two calcite veins occur on that property, 300 feet apart, both running northeast and southwest. The one to the northwest is in diabase and is rich in silver, with smaltite; while the other is in slaty agglomerate and carries no silver. The widest part of the productive vein is four inches. The mine consists of an open cut 60 feet long. Ten tons of ore have been shipped.

Mr. Richardson also informed me that the Violet mine, on the lot adjoining the Hanson to the north, is entirely in diabase. Some of the rock is here rather coarsely crystalline, while some of it is fine-grained and as darkly colored as that of the Jacobs mine. The Violet mine has a shaft 90 feet deep and a cross-cut level has been stared to the southward. A little silver ore has been taken out of an open cut. Both the Hanson and the Violet mines show a good deal of smaltite.

The Drummond mine is at the east end of Kerr Lake. Here two smaltite veins occur about 8 feet apart. Between these, horizontal streaks of silver are found in the agglomerate which constitutes the country rock. There is an open cut about 20 feet deep and a shaft is being sunk.

The northern angle of the Lumsden and Booth, or Gillies, timber berth protrudes from the south into the centre of the silver district. This has not been disposed of by Government for mining purposes and it has not been referred to in the above descriptions of silver-bearing properties, although some rich veins are known to occur in it.

The number of veins or vertical zones of fracture carrying silver, which have been already found in so limited an area as the Cobalt silver district, must be considered large, and the question is asked—what are the prospects for further discoveries within the district in the future? Where so many discoveries have been made, while so large a proportion of the surface of the rock is covered with earth and this again by a thick growth of coniferous trees and deep moss, it is reasonable to expect that many more will follow when the timber is removed and extensive costeaning is undertaken.

The Nipissing Company is installing heavy machinery for the purpose of pumping water from Petersons Lake to high levels, with a view to washing the earth entirely off the surface by the hydraulic process. This will allow of a complete search being made for the outcrops of the vertical silver-bearing zones, which are often inconspicuous at the surface and might escape discovery by the ordinary methods of prospecting.

From our present knowledge it would appear that the silver has a regional environment as well as certain local geological relations, resembling the mode of distribution of the richer nickel ores in the Sudbury district. There, outside of a certain area, although the geological conditions may be similar, no one ore rich enough to work can be found. Similar phenomena obtain in other parts of the world in regard to other metals, such as tin and mercury. Although diligent prospecting has been carried on throughout a large area outside of the silver district immediately around Cobalt, no discoveries of similar occurrences of silver have been made. I may, however, mention that traces of native silver have been discovered recently on the east side of Lake Timiskaming at a place which lies in a line with the northeasterly course followed by the successive silver mines in the centre of the Cobalt district. This discovery is close to the Wright silver-lead mine, which is in a very pronounced volcanic agglomerate. A thorough exploration of this part of the lake shore and the country behind it might bring out interesting results.

Small quantities of smaltite have, however, been found in different localities beyond the silver district. It now appears that the silver is not necessarily connected with this mineral. It has been mentioned on a previous page that in the Cobalt district the largest bodies of smaltite so far tested contain only traces of silver. Unless the conditions necessary for the production of the silver itself are repeated in some other locality no further important discoveries of this metal may be made in this part of Canada.

One of the most vital questions in connection with the silver mining in the Cobalt district is that respecting the depth to which the deposits may continue. The direct evidence afforded by the main vein of the Larose mine carries us down only 205 feet from the collar of the shaft, but the silver-bearing character of two other veins, which cut the 80 feet of agglomerate, etc., above the level of the collar, may be considered in this connexion, which would give us a depth of nearly 300 feet. The ore and rock brought up from the lowest workings of this mine show that the vein has undergone no material change so far, being about equally rich and varied in its contents all the way down; but, as above mentioned, there is in the lowest workings an increase in the proportion of argentite, and the vein and its walls have a firmer and fresher character. Good-sized flattened nuggets continue to be found among the native silver. At the 800 feet level the line of fracture is marked by two parallel calcite veins of 5 and 7 inches respectively, separated by an interval of slaty tufa, rich in native silver, which also extends, as thin plates, into the wall-rock on either side, as far as four feet in some parts.

It may be reasonably supposed that the farther a vein can be traced on the surface, the deeper it is likely to go. Although nearly all the individual veins are small, they may be regarded as only one manifestation of a mineralized plane or zone of fissure or disturbance. The fact that these fissure-planes, or lines of fracture, are vertical, and that they coincide with the prevailing system of strong joint-planes are circumstances favorable to persistence in depth. The agglomerate and its associated rocks have been found, by means of the shaft and boring at the Larose mine, added to the height of the rocks above the shaft, to have a depth of at least 300 feet, but it may be much greater than this. The thickness of the jointed agglomerate may be found to have some influence, not only on the depth of the fissures, but also on their argentiferous character, as the silver appears to have been derived from the country-rock in which the veins occur. If the veins prove to pass down through the agglomerate into some underlying rock their sliver contents may continue downwards with them.

If a comparison be made between the geological and mineralogical conditions at Cobalt, and those of the Thunder Bay silver region, it will be found that there are more points of difference than of resemblance in regard to the principal group of mines in the latter region, which embraces the Rabbit Mountain, Silver Mountain, Porcupine, Beaver and West End mines. In all these the silver occurs, both native and as argentite, in well-marked brecciated veins of quartz, which cut down through a heavy sheet of diorite into a great thickness of darkly colored unaltered shales, lying horizontally. These belong to the Animikie series, which is much newer than the rocks of the Cobalt district. The conditions at the Shuniah and Thunder Bay mines a short distance northeast of Port Arthur, have some resemblance to those of the mines just mentioned, and both of them were rich in native silver at the surface, but on sinking, it soon gave out. At the Silver Islet mine the conditions were quite different. A broad dike of a peculiar variety of diorite, which can be traced for miles parallel to the northwest shore of Lake Superior, cuts through a great thickness of nearly horizontal gray and nearly black unaltered shales. A very strong vertical calcite vein cuts this dike almost at right angles. Ex-

The Station at Cobalt.

Group taken in the outcrop of a Cobalt vein.

cept where traversing the dike, the vein holds nothing but a little galena. But the part which lay within the dike, and constituted a perpendicular square prism, proved to be rich in argentite and native silver, to a depth of about 1,000 feet, when it began to fail and at 1,200 feet it had become so poor as to be no longer worth working. The total value of the silver taken from this mine amounted to about $3,250,000. The rock of the dike itself, on analysis, was found to contain a variety of metals in notable quantities.

On the shore of Thunder Bay, a short distance to the northeast of the Shuniah and Thunder Bay mines, a rather small vein which cuts both the Huronian and Animikie rocks was worked to a limited extent under the name of the 3A mine. It was noted for producing occasional specimens of nickelite.

COPPER STATISTICS.

The fourteenth annual issue of Messrs. Aron Hirsch & Sohn's Copper Statistics gives the copper production of the world for the preceding twelve months. The following extracts should be of interest to all connected with the mining, smelting and refining of copper:—

The most complete estimate of the world's copper production is published by Henry R. Merton & Co., Ltd., of London, whose figures for 1905 are not yet available. We give their figures for former years for comparison:

1880: 153,959 t, 1885: 225,592 t, 1891: 279,309 t, 1892: 310,472 t, 1893: 303,975 t, 1894: 324,405 t, 1895: 334,565 t, 1896: 373,363 t, 1897: 397,390 t, 1898: 424,126 t, 1899: 470,866 t, 1900: 486,084 t, 1901: 518,788 t, 1902: 542,470 t, 1903: 565,828 t, and pro 1904: 640,935 t.

STATISTICS OF THE PRINCIPAL COPPER CONSUMING COUNTRIES.

Germany.

Importations, except ores:	1904.	1905.
From United States	98,417	90,202
From other countries	30,555	33,830
Total	128,972	124,032
Less re-exports	14,343	17,663
	114,629	103,369
Production, including prod. from imported ores	30,456	30,533
Home consumption	145,085	136,902
Exports of manufactures	64,085	77,993

The apparent decrease in German consumption, contrary to the evident better business of the copper consuming industries, is explained by the fact that the high prices ruling in 1905 caused consumers to reduce their supplies to a minimum, while in 1904, foreseeing the advance in prices, consumers had bought freely forward.

A careful investigation of the different branches of consumption of copper in Germany has resulted in the following estimate:—

	1904. Tons	p. cent.	1905. Tons	p. cent.
Electrical machinery and copper wire	59,000	40.50	57,500	42
Sheet copper; Copper rolling mills.	23,000	16	24,000	17.50
Brass mills	37,000	25.25	35,000	25.50
Chemical industry and blue vitriol makers	2,000	1.25	2,000	1.50
Shipyards, railroads and miscellaneous casting	25,000	17	18,500	13.50
	146,000		137,000	

The above figures of consumption do not provide for the movement of old metals in Germany. We estimate that about 20,000 to 25,000 tons of old metals pass annually back into consumption, and this quantity has to be added to above figures in order to arrive at the figure of actual consumption.

There is no Metal Exchange in Germany and consequently no stocks of copper are accumulated, the quantities imported going practically all into the hands of consumers.

The outlook continues to be an excellent one.

England.

	1904.	1905.
Imports of copper in ores, pig or refined.	157,897	139,313
Domestic production	225	200
	158,122	139,513
Decrease of stocks	......	3,047
Increase of stocks	3,048	......
	155,074	142,560
Exports of crude copper	21,794	35,162
Domestic consumption	133,280	107,398
Exports of manufactures	34,617	31,590

(In figuring up the English copper consumption, the increase or decrease of stocks carried in public warehouses is taken into consideration.)

United States.

	1904. Tons.	1905. Tons.
Production: Reporting mines	366,522	397,545
Production: Outside sources	......	......
Imports (less re-exports)	79,910	94,211
	446,432	491,756
Home consumption	214,285	277,053
Exports to Europe	247,421	239,863
Stocks at the end of the year	79,094	56,762

The figures of consumption for 1904 are estimated on the following basis:—

January to March	40 millions lbs. monthly	120 mil. lbs.
April to June	38 " " "	114 " "
July to September	39½ " " "	118½ " "
October to Dec'ber	42½ " " "	127½ " "
		480 " "

or 214,285 gross tons.

The figures of consumption for 1905 are estimated on a basis of a consumption of 50,000,000 lbs. per month, but as good authorities think this basis was exceeded in certain months, we add an amount of 5,000 tons for the year, viz., 600,000,000 lbs. equal to 272,053 tons plus 5,000 tons making a total of 277,053 tons.

Details of Production.

	— 1904 — corrected figures, according to the Geological Survey.	— 1905 — Our own estimation.
Lake Superior	208,309,130 lbs.	218,000,000 lbs.
Arizona	191,602,958 "	231,000,000 "
Montana	298,314,804 "	325,000,000 "
New Mexico	5,368,666 "	5,000,000 "
California	28,529,023 "	21,000,000 "
Utah	47,062,889 "	58,000,000 "
Colorado	9,506,944 "	10,000,000 "
Alaska	2,043,586 "	5,000,000 "
Wyoming	3,565,629 "	2,500,000 "
Idaho and Nevada	2,158,858 "	1,000,000 "
Tennessee and Southern States	15,211,086 "	12,000,000 "
Other States	863,694 "	2,000,000 "
	812,537,267 lbs. = 362,740 t.	890,500,000 lbs. = 397,545 t.

In our last year's issue, we pointed out the importance of the American production upon the world's copper market, and paid a tribute to the far-sighted policy which guides the actions of the able leaders of the principal producing companies .

Stocks on 31st December, 1905, are shown to be 56,762 tons; we would, however, call attention to our last year's observation of the fact that, of the total American production of Electro Copper, two months' production is always partly in course of transit to smelters and partly in the process of electrolytical refining, being thus withheld from the market.

We ascertain the production of electrolytical copper by deducting from the total production, those quantities which were either delivered in the form of unfinished products, such as Matte or Blister Copper or subjected to the fire process, as Casting or Lake Copper.

		1904.		1905.
Production, including imports		446,432 t		491,756 t
Unrefined Pig-Copper exported to Europe	20,143 t		14,953 t	
Mattes exported to Europe	466 t		50 t	
Production of ordinary Casting Copper (estimated)	25,000 t		35,000 t	
Production of Lake-Copper (estimated)	78,000 t	123,609 t	85,000 t	135,003 t
The Electrolytical Copper production is consequently		322,823 t	and	356,753 t

This latter figure of 356,753 t, arrived at by indirect method, is confirmed by the fact that the capacity of the ten largest American electrolytic refineries amounts, as we know, to about 350,000 tons.

One-sixth of this amount, i.e., two months' production, is about 55,000 t, after deduction of which it is seen that the apparent stocks of 56,762 tons are actually not available.

Last year we drew attention to the fact that a total of 25,000 tons available stocks with a production of 446,432 tons, was dangerous. It is immediately clear that this year, with no stocks at all, the position is accentuated.

We add detailed comparative figures for the principal producing districts:—

	1904. Tons.	1905. Tons.
Arizona	85,267	103,128
Michigan (Lake)	93,750	97,321
Montana	139,280	145,088
All other States	48,225	52,008
	366,522	397,545

France.

	1904. Tons.	1905. Tons.
Imports of crude copper:		
From United States	40,096	35,943
From other countries	19,478	22,188
Imports copper in ores (contents estimated)	6,000	5,600
	65,574	63,731
Decrease of stocks	......	1,279
Increase of stocks	1,340	......
Consumption	64,234	65,010
Export of manufactures	11,315	8,556

(Our estimates of French copper consumption have differed for the last ten years from those compiled by other statisticians, but our method of getting up the figures for France is the same as for all other countries and, therefore, preferable for purposes of comparison).

Austria-Hungary.

	1904. Tons.	1905. Tons.
Imports of crude copper:		
From United States	13,418	13,648
From other countries	9,114	8,886
Imports of copper contained in ores, old metal, etc.	4,849	5,530
Total imports	27,381	28,064
Brought forward	27,381	28,064
Domestic production	1,150	1,500
	28,531	29,564
Exports of crude copper, etc.	2,165	3,734
Home consumption	26,366	25,830
Export of manufactures	1,977	2,369

Russia.

	1904. Tons.	1905. Tons.
Imports of crude copper	20,326	19,688
Imports of manufactures	344	409
Domestic production (1903, est.)	10,700	8,700
	31,370	28,797

Italy.

	1904. Tons.	1905. Tons.
Imports	14,190	16,051
Exports	195	155
	13,995	15,896
Domestic production estim.	3,500	3,300
	17,495	19,196

SUMMARY AND REVIEW.

During the last few years, we have regularly been able, when looking back upon the last year, to describe same as a record year of the copper mining industry. It would seem as though this phrase is becoming a permanent one, for each year exceeds the preceding one, in quantity of production:—

We recapitulate the figures of the world's production:
1904—640,935 tons. 1905—697,845 tons.

Of late years, the copper production has been growing at the rate of about 8 to 10 per cent. per year; it is, however, worthy of note that the increase in the production of 1905 over that of 1904, viz., 56,910 tons (640,935 : 697,845) was proportionally smaller than that of the years 1891: 1892, viz., 31,163 tons (249,309 : 310,472).

Note the increase of over 100 per cent. in ten years from 1894—324,405 tons to 1904—652,522 tons.

According to our information one may reckon upon an increase during 1906 of 55 to 60,000 tons in the world's production, of which 50,000 tons approximately may be reckoned as being the increase of the United States, Mexico and Canada together.

Consumption of Copper.

	1904. Tons.	1905. Tons.
Germany	146,006	137,975
France	64,234	65,010
United Kingdom	133,280	107,398
United States	214,285	277,053
Austria	26,366	25,830
Russia	29,624	28,794
Italy	18,162	20,314

Estimated figures of the consumption of the less important European countries:—

	1905. Tons.
Belgium	8,000
Scandinavian countries	3,000
Spain, Switzerland, Levant	2,500
	13,500

As to the Far East we have taken special care to arrive at a fair estimate and give the following figures as approximately correct:—

	1904. Tons.	1905. Tons.
Asia	38,175	85,743

The two latter figures are compiled as follows:—

	1904. Tons.	1905. Tons.
Japan's production (minus exports to Europe)	25,000	29,400
Australia's exports to Asiatic countries.	7,000	10,000
United States exports to Asiatic countries	4,675	43,343
Europe and other countries exports to Asiatic countries	1,500	3,000
	38,175	85,743

Recapitulating, we arrive at the following comparisons of consumption and production:—

	1904. Tons.	1905. Tons.
Germany, United Kingdom, France, United States	557,805	587,436
Austria, Russia, Italy	74,152	74,938
Other European countries	13,500	13,500
Asia	38,175	85,743
	683,632	752,617
Production	652,522	697,845
Excess consumption	31,110	54,772

In consequence of bad trade, there were at the end of 1901, large stocks of copper on hand; since then, however, stocks have been regularly diminishing. Of course, the large quantities of old copper which are always in existence add appreciably to the world's supply, and, as explained in former issues, renders the giving of exact figures impossible. The phenomenal Asiatic consumption of last year, is an event which is unique in the history of copper statistics.

Prices.—The copper trade of the world knows four principal grades and qualities of copper, viz., in the United States: Lake and Electrolytic-copper, in Europe: Best Selected and Standard copper. As "Standard copper" is known the staple article which is dealt in on the London Metal Exchange, and which fluctuating widely, serves as a plaything for speculators while the trade in the other grades mentioned is carried on in a quiet and steady manner merely for the purpose of supplying the legitimate wants of consumers. Owing to the continued decrease of supplies of so-called Standard copper as compared with the increasing trade in other grades, and in order to prevent a corner which might have been easily engineered with stocks down to 4,277 tons Dec. 31st, 1903, the London Metal Exchange has since 1904 adopted a rule permitting the delivery of the three trade qualities against Standard contract on a fair basis, viz., high conductivity copper assaying 99.80 per cent. and more, deliverable at a premium of £1.—, Tough, Best Selected and Casting copper grades assaying 99.30 and over, at a premium of 10s—p. ton, material assaying 99—99.30 per cent., at par, if below 99 per cent., but minimum 96 per cent. at £1.10—discount. The discount of 2½ per cent. heretofore customary has been abolished.

Although deliveries of refined copper against Standard contracts are not frequent, we consider the rule adopted an excellent one and wholesome for the market, because it tends to lessen the dangers of a corner. The market for Standard copper, subject to nervous fluctuations like every market made on an open exchange, remains, however, in spite of the above mentioned rule, too small to be considered a fair criterion for the price movement of the real copper used by consumers; stocks at the end of 1905, amounted only to 4,223 tons. Nevertheless everybody interested in copper all over the world looks at the quotations made twice daily on the London Metal Exchange and is influenced more or less by the ups and downs of this market, in his decision as to the course to pursue regarding purchase or sale of crude or refined copper. While this attitude is justifiable in a way, we wish to warn all parties interested not to place too much importance on the daily fluctuations and small variations of the London quotations, which, as a rule, do not foreshadow coming events, but are the outcome of speculative opinions.

We add comparative figures for the four principal grades of copper for 1905:—

Electrolytic in Cents:	Jan.	Febr.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Average price
Lowest price	15.—	15.20	15.20	15.12½	15.—	15.—	15.—	15.45	16.22½	16.37½	16.50	17.07½	—.—
Highest price	15.20	15.20	15.20	15.20	15.—.—	15.—	15.37½	16.62½	16.50	16.50	17.75	18.75	—.—
Average price	15 15	15.20	15.20	15.18	15.—	15.—	15.11	15.87½	16.22½	16.50	16.84½	18.59	15.82.3
Above mentioned price for Electrolytic equiv. in £ per ton	69.14.7	69.18.5	69.18.5	69.16.7	69.—	69.—	69.10.1	73.—.6	74.12.7	75.18.—	77.9.9	85.10.3	72.15.9
Lake in Cents	15 28	15.32.5	15.32.6	15.27	15.—	15.—	15.11	15.87.5	16.22 5	16.50	16.87	18.59	15.89
Lake equiv. in £ per ton	70.5.9	70.9.10	70.9.10	70.4.10	69.—	69 —	69.10.1	73.—6	74 12.7	75.18	77.12.—	85.10.3	72.19.5
Best Selected £ per ton	71.17.9¼	71.5.—	72.6.1¼	71.8.9	69.14.5¼	70 10.6¾	71.10.7½	74.18.11	75.13.4	76.17.9¼	79.6.10½	86.—	74.5.10
Standard £ per ton	68.8.7½	67.19.8¼	68.3 8	67.0.7½	64 19.8	66.—3	66 17.8	70.—.11	69.16.6½	71.18.2¼	74.17.10	79.—6¼	69 12 0¼

In our last year's statistics, we gave it as our firm opinion that the world's demand during the year 1905 would be very great, and that the phenomenal demand of Europe in particular would be sustained. We further stated that the United States of America would require 50 million pounds monthly, i.v., 300,000 short tons, in the course of the year and that the production, greatly increased as it was, would be entirely absorbed, especially in view of the expected far larger demand of Asia.

All this has come to pass; still further, the demand has greatly surpassed the production, for not only the European, but also the American stocks were almost exhausted at the end of 1905.

The English and French stocks sank from 10,009 tons at end of 1904, to 5,687 tons at end of 1905, and since then have fallen by a further 1,500 tons, whilst the American stocks fell from 79,094 tons to 56,762 tons during the same period.

This proves clearly that not only is the world's production which rose in this one year from 640,935 tons to 697,845 tons entirely exhausted, but also that consumers had to fall back upon the supplies, already so scanty at the end of 1904. It may, too, be mentioned that about two-thirds of the stocks of England and France consisted of the less valuable "Standard Copper," which is rather an article of speculation than a material which can be used by the majority of consumers.

We have explained that of the 56,762 tons, of which, according to our statistics, the American stocks exist; about 55,000 tons must be considered as an unavailable quantity, as this amount is withdrawn from use, being either in the course of refining or en route.

One must also take note of the fact that the Geological Survey in Washington fixed the supplies on 31st December, 1904, at only 119,215,597 lbs., or 53,221 tons, which is again a reduction of 25,000 tons as compared with our last year's estimate of 79,094 tons.

All these facts taken together afford absolute proof that at no time in the modern history of the copper market was there such a dearth of supplies and did copper consumers so strongly feel the consequences of a copper famine, as at the present time. In December, 1905, it was often not so much a question of price as an actual lack of material which consumers felt so keenly. Many works had to curtail the extent of their manufactures, it having been impossible to obtain sufficient raw material in time, although the mines and refineries sent off supplies, so to speak, hot from the oven. Contrary to all previous experience, consumers demanded delivery at the beginning of a month of copper, which, under contract, was due only in the course of that month. Producers were of course for the most part entirely unable to accede to this wish. It is therefore quite natural that relations between producers and consumers often became strained, without either party being actually to blame.

Now—end of February—the situation is in a somewhat better position, in as far as sellers are better able to conform to the wishes of purchasers regarding deliveries of quantities which had been contracted for in advance. Nevertheless, the fact remains that copper for prompt delivery is unpleasantly scarce.

Under these conditions, the development of all copper consuming industries was periodically considerably affected; it is, however, to be hoped that occurrences of such a nature will not reappear during this year, as the expected increase in the world's production, which we tax at 50,000 to 60,000 tons, will aid matters considerably.

We predict with the utmost confidence that the excellent conditions of the industry in Europe and America will be sustained, and base our opinion on that fact that orders have been booked for months in advance, and besides many large new undertakings have to be supplied with material. Even a bad condition of the stock markets, which might be caused by dear money, would have no adverse effect of any importance upon the healthy conditions which now reign in the copper consuming industries.

The reason for the insufficient material which European manufacturers have in hand is as follows:

In the months of September and October, 1904, when copper in New York rose from 12¾c to 13¾c, a further advance of price was foreseen, in view of the increased demand, and consumers bought in advance to cover their requirements for some months to come, in order not to have to pay the expected higher prices. It was indeed a fact that the months of November and December brought prices of 15c to 15½c. Hence the tactics of consumers proved to be correct. They then thought, however, that by adopting a waiting policy, they would induce the American producers to come down to their ideas. This expectation was not realized, for they had reckoned without their host, America having meanwhile developed a home-demand, which prevented a fall in price. Thus in the summer of 1905, prices remained over 15 cents, in August they advanced to over 16 cents, and by December, had risen to between 18 and 19 cents. Prices have not yet (end of February) suffered any decline and a continued firmness of the market must be expected.

It is worthy of attention that the Chinese, in view of the advance of price witnessed during the last quarter of 1905, were able to make considerable profit by re-selling large quantities of copper to Europe. The total amount of these unexpected European supplies—consisting partly of re-shipments from China, partly of direct shipments to Europe, from America, of quantities bought by China but not yet delivered—was more than 15,000 tons. But even these unexpected considerable supplies, were only sufficient to temporarily somewhat depress price; these facts offer further proof of the scarcity of the world's supplies.

Another effect of the Chinese re-sales is that China is now almost without any copper at all, and will have to reappear in the world's market, directly she experiences any fresh demand.

The industrial demand has too certainly not yet arrived at a standstill. As a rule, after such a big rise, a reaction sets in or there is at least a temporary pause; in the present case, however, there are sure indications of a large demand in 1906.

Railroads, shipbuilding, electric railways, etc., all require large supplies; the electrical trade all over the world is expecting extension of trade.

The Boston News Bureau, a well-informed organ, states on the 6th Feb. of this year that whereas the General Electric Company had in 1899 8,000 workmen, they now have 24,000; this company is so well supplied with orders even up till the autumn that is already partly covering its requirements in spite of the present high level of prices.

Similar conditions reign in Germany. The Allgemeine Elektrizitats-Gesellschaft has seen its staff advance during the same period from 13,000 to 30,000 men; we agree with this company in their opinion that a far greater consumption took place in Germany in 1905 than in the previous year, although the copper imported fell from 134,972 to 130,532 tons.

Of England the same tale may be told. In spite of the lesser amount imported in 1905, viz., 139,313 tons as compared with 157,897 tons, in 1904, the consumption in this country has not grown less. Every kind of material has everywhere been consumed. The Americans are most sanguine when they affirm that their own production of pig iron, which amounted in 1855 to but 563,000 tons, in 1905, however, to 22,000,000 tons will increase to 40,000,000 within the next 10 to 15 years. As for copper, it is expected that the present American demand of 300,000 tons will advance to 1,000,000 tons in the same period. Even if we Germans are not so extravagant in our forecasts, nevertheless when one looks back, one must perforce admit that the ideas of our friends over the water may after all not fall so short of the mark.

Germany's consumption of copper amounted in 1880 to 19,622 tons; 1891, 56,888 tons; 1900, 116,900 tons; in 1905, 137,975 tons. A glance at the figures of production teaches us that the consumption is capable of considerable increase. As already stated, these figures were in 1800, 9,000 tons; 1830: 21,000 tons; 1860: 90,000 tons; 1870: 100,000 tons; 1880: 200,000 tons; 1890: 269,000 tons; 1900: 480,000 tons; 1905: 697,765 tons. Again, one must certainly take into consideration the doubtlessly developing demand of Asia. Central and North America are also coming more and more into the scene of action.

The development of the German coal production of pig iron rose (reckoned in million tons) from 2.1 in 1876 to 8.5 in 1902 and 10.9 in 1905.

Reckoned per head of the population, the coal demand rose from 1,170 kilos. in 1876 to 2567 kilos. in 1902 and 2,893 kilos in 1905, and that of pig iron from 51.6 kilos in 1876 to 141.1 kilos. in 1902 and 181.6 kilos. in 1905.

The North Americans reckon their present pig iron demand at 630 lbs. = 283 kilos. per head. This latter high figure can be well understood when one considers that the length of the North American lines of railroads amounted in 1902 to 325,777 km. (in 1905 to 362,000 km.) as compared with 296,051 km. for the whole of Europe, of which Germany's share is 53,700 km.

The growth of German trade statistics also shows healthy and encouraging signs of development. Since 1893 our imports have risen (reckoned in million tons) from 35.1 to 54.3 in 1905, and during the same period, our exports have risen from 25.9 to 40.5.

These general statistical determinations may serve to enable one to judge the copper statistics in combination with events connected with other commodities, and not narrow-mindedly and from the standpoint of the article itself alone.

We expect this year to be a year of peace and believe one may expect that the great demand which is expected will meet with adequate supply to the blessing of the mining industry and the copper industry in general.

COBALT CAMP.

Shipments of silver ore from Cobalt during the month of September amounted to twenty-five carloads, divided as follows:—

The Kerr Lake Mining Co.	2	cars.
Nipissing Mining Co.	9	"
University Mining Co.	2	"
Buffalo Mines	4	"
Drummond Mines	2	"
Larose Mining Co.	3	"
Silver Queen	1	"
Violet Mines	1	"
Nova Scotia Mines	1	"

It is probable that these carloads of ore were fully as valuable as those that have been shipped heretofore, though, at present, it is impossible to be certain of this. The list does not include, by any means, all the mines that have shipped ore, as several of them are holding back awaiting smelting facilities.

Seeing that the mines that are now sufficiently developed to ship, are down but a few feet it is evident that the possibilities of the camp are very great, for, though Cobalt in itself has produced a large amount of valuable ore, better still, it has stimulated enquiry as to the vast regions upon the outskirts upon which it is situated. Hundreds of men have been in the northern woods this summer, and within a few weeks we may hope to hear that some of them have been successful. The latest report as we go to press, is that gold has been found in paying quantities on the north shore of Larder Lake. This lake is on the Ontario side of the Interprovincial Boundary, a few miles south of the Height of Land. The officers of the Geological Survey are to be congratulated, that in a recent report, they indicated the probability of gold being found in these regions, although, they seem to have inclined to the belief that Lizard Lake, east and south of Larder Lake, would be the probable scene of the discoveries—and it is quite possible that their predictions may be verified in the near future.

RENEWAL OF MINING ACTIVITY IN THE THUNDER BAY DISTRICT.

Mr. E. D. Ingall, mining engineer of the Geological Survey, has just returned from a toui amongst the copper mines of northwestern Ontario. The conclusions at which he arrived will shortly appear in the Department's Summary Report, but meanwhile it is no secret that Mr. Ingall was considerably impressed by the renewed activity in the copper districts, due to a large extent to the present high price of that metal, but also to their being more easily accessible than formerly.

Mr. Ingall says that prospecting for copper ores is just now very active and that development and exploratory work are being prosecuted at a number of points along the north shores of Lakes Huron and Superior.

Underground development is being actively continued at the Tip Top mine, near Lake Shebandowan, west of Thunder Bay as well as at the Herminia, Deal Lake, Superior, Echo River, and at various points distributed along the range of country lying adjacent to the north shore of Lake Huron and between the well-known nickel-copper ore district of Sudbury on the east, and the eastern shores of Lake Superior.

The wide distribution of copper ores throughout this region was pointed out in the earliest publications of the Survey and interest attaches to the recent reopening of the Bruce mines series of veins. These were operated as far back as the year 1847, and mining was successfully continued for a period of some twenty-eight years when the difficulties due to their isolated situation and the drop in the piice of copper caused a cessation of mining. Now after a long period of rest and various vicissitudes these old and interesting mines are being reopened by an English Company and it is believed that, with higher prices for the product together with the great improvements in methods and machinery and in the general conditions of the district, operations can be carried on with profit.

The already proved prevalence of copper ores over so extensive a territory, together with the present activity in exploring and the promising nature of some recent discoveries, justifies the hope that the problem of profitably treating the sulphuret ores of northwestern Ontario will be solved at an early date.

CORRESPONDENCE.

OUR NOBLE HERITAGE.

The Editor Canadian Mining Review:

Dear Sir,—Your extra copy of the Mining Review for August was duly received on my return from Europe, where I was sent for a few weeks' rest.

I notice that you have honored me with a review of my little work compiled at the time that the Parliament of Canada wanted information on the resources of the country between Quebec and Winnipeg, along the line of the National Trans-Continental Railway.

From the notes of the surveyors and the accounts given me by them along the same line since the blue-book was prepared, I can state that the most sanguine expectations as to the resources — mineral, agricultural, and others, have been realized and even surpassed.

I firmly believe that we shall have areas of untold mineral wealth in the various belts of Huronian rocks which are to be traversed by the new Trans-Continental Railway. Iron, copper, nickel, silver, and gold will be the chiefest, whilst rarer elements, including the precious metals and stones, and gems, may be expected.

Ever since Prof. Hobbs has advanced his report on the occurrence of diamonds in the drift of the Northern States, I have been a firm believer in the likely discovery somewhere in Canada of a diamond-bearing field. It is a simple bit of inductive reasoning, a clear piece of logical deduction from the facts and phenomena observed and discovered by Prof. Hobbs's researches.

The 14,000 copies of this blue book prepared and the demand for the same have shown how eagerly such a report, even though a Government blue book, is sought after.

The amount of further information which has been asked of me at the department since the publication of the same, and the large amount of material which has been gathered in the way of samples of rocks and minerals of economic value show clearly what a mineral-bearing belt the Huronian is throughout the region in question, and the Great or Abitibi Belt of Huronian rocks carrying minerals will form an area of enormous size and wonderful wealth as the country is being opened up. The discovery of minerals will lead to the development of the agricultural capabilities which, I truly believe, will not be inferior to the mineral wealth. The vast areas of loamy soil and good agricultural ground in the Hudson Bay Basin, the character of the climate as well as the attendant conditions, must some day soon be developed. There are many persons who prefer settling in districts where there are trees and diversified features of the land rather than settle on the treeless prairie. These will find a suitable place in the silver and gold region of the country traversed by the Trans-Continental Railway, especially where the marine sediments of the Bay have been laid over the flat-lying rocks of the Palaeozoic Basin, or over the old crystalline and mineral-bearing formations.

The fact that Hudson Bay does not freeze across, any winter season, but only along a margin or fringe of some nine or ten miles (as we have been credibly informed by explorers), which bay covers an area of not less that 567,000 square miles of salt water, which attracts and draws heat-rays and heat within its bosom during the summer-time, this fact, means that a most powerful influence is exerted by the waters of this bay upon all the country around, the whole year round.

The resources of Canada are only beginning to be made known and to be appreciated. Legitimate mining can and will be carried on in this country soon which will astonish even the most enthusiastic. To have faith in our own resources as the result of personal observation is not a difficult task. It is for those who have the means to develop—to go-ahead with the financing of the enterprises in opening the bosom of Mother Earth and obtaining the treasures that are therein stored up.

I have great faith in the future of the North Country between Quebec and Winnipeg a long the line of the national Trans-Continental Railway and its coming ramifications which will tie together the two great basins and give us an area of forest lands and picturesque scenery. There will be Trans-Laurentia and a Cis-Laurentia. We in the older settled portion of Eastern Canada occupy Cis-Laurentia, whilst the new basin of the James Bay region, with its great alluvial plains and fertile belts, will constitute the Trans-Laurentia, a fair rival with fine possibilities.

Yours very sincerely,

H. M. AMI.

Ottawa, August 28, 1906.

THE MINING PROMOTER.

We have all met the persuasive individual who, armed with a prospectus full of glittering promises and holding out roseate hopes of the "get-rich-quick" order, goes about seeking his victims among people chiefly in moderate circumstances. We have also read the literature which he hands about promiscuously, and wherein a so-called mining expert draws upon his vivid imagination in describing the enormous extent and depth of the ore bodies. In such literature we generally encounter our old friend, the true fissure vein, which is supposed to go down to immeasurable depths, of course becoming better all the time.

We have also met the matter-of-fact business man, who was willing to give full information about the mining properties which he has, clearly stated his reasons for believing in their value, and was willing to submit them to expert examination. Unfortunately the first class is more in the public eye, and they have done a greal deal to hinder the development of legitimate mining enterprises.

It has come to pass that among certain classes of even otherwise well-informed people, investment in mining stocks is considered little else than a form of gambling, with the odds greatly against the investor. Of course the element of chance and the possibility of getting quick returns for the money invested is one of the prime incentives for investment in new or partially developed mines. If that element were removed people might as well invest their money in Government bonds or other sources from which they derive a small but sure income. Before a certain stage of development is reached there is in all such propositions that element of speculation which is inseparable from mining enterprises. Confidence in the future is required to make a paying mine out of a hole in the ground. The legitimate development of mining propositions is, however, very far removed from mere gambling. There is no question that the honest bona-fide promoter, notwithstanding the bad repute into which this title has fallen, in his capacity as the man who stands between the miner and the investing public fills a useful and very necessary place. The mining engineer in active practice of his profession seldom has time and very often lacks the opportunity to attend also to the financial details. The point on which the honest promoter differs from the dishonest one is that the latter does not give the investing public a correct idea of the chances which they have to take when they go into the enterprise. It is not the question as to what the chances are which have to be taken, but the man who invests his money in a mining property which is to be developed, certainly has the right to know and clearly recognize what the chances are that he is taking. If the venture is a gamble, he should know it and govern himself accordingly.

Recognizing the deleterious influence which the unscrupulous promoter exerts on legitimate mining, it is the plain duty of every mining engineer who takes pride in the good reputation of his ancient and honorable calling, to do his share toward exposing any fraudulent schemes that come to his knowledge.—Mining Magazine

We are in receipt of Volume 14 of the Transactions of the Association of Civil Engineers of Cornell University. It contains the addresses made by non-resident lecturers, miscellaneous papers, and a list of members of the Association. Most of the papers are well thought out, and that on the "Requisites of a Civil Engineer," by Gen. W. S. Smith, is as pertinent to mining as to civil engineering.

SIX MONTHS' COPPER.

We are in receipt, through the courtesy of Messrs. L. Vogelstein & Co., New York, of the figures of the German consumption of foreign copper for the months from January to July, 1906, inclusive:—

Imports of copper in July	8,163 tons	
Exports " " " "	619 "	
Consumption " " "	7,544 "	
Imports of copper, Jan. to June.	66,679 tons	
" " " July	8,163 "	
		74,842 tons.
Exports of copper, Jan. to June.	5,564 tons	
" " " July	619 "	
		6,183 "
Consumption, January to July		68,659 "

Out of the above, 7,183 tons were imported from the United States.

CAPTURED THE WEST.

The Canadian Society of Civil Engineers promoted a pleasant party to the Pacific Coast. Visits were made to Fort William, Winnipeg, Vancouver, Victoria, Nelson and other cities. In each engineering works and mines were inspected. The personnel of the party was made up as follows:—

Mr. A. Amos, Mr. C. W. Archibald, Mr. and Mrs. W. D. Baillairge, Mr. N. T. Bertrand, Miss Bray, Mrs. Boyd, Mr. W. Bucke, Mr. R. deB. Corriveau, Mr. E. L. Cousins, Mr. and Mrs. Chanute, Mr. F. A. Drought, Mr J. Duchastel, Mr. G. H. Frost, Mr. J. C. Greey, Mr. S. Groves, Colonel Jones, Mr. and Mrs. T. H. Jones, Mr. F. S. Keith, Mr. J. Kennedy, Captain B. Lindsay, Mr. W. Kennedy, Mr. and Mrs. La Violette, Mr.

C. deB. Leprohon, Mr., Mrs. and Master Miller, Mr. C. H. Mitchell, Mr. G. D. MacKinnon, Mr. W. A. Murray, Mr. T. C. McConkey, Professor C. H. McLeod, Miss McLeod, Mr. and Mrs. R. F. Ogilvy, Professor R. B. Owens, Mr. and Mrs. Papineau, the Misses Paverley, Professor J. B. Porter, Mr., Mrs., and Miss Ross, Mr. S. F. Rutherford, Dr. E. Seaborn, Mr. F. P. Shearwood, Mr. and Mrs. Frank Simpson, Miss Smith, Mr. and Mrs. W. J. Sproule, Mr. L. A. Surveyor, Mr. and Mrs. Sweet, Mr. E. VanWinkle, Mr. and Mrs. Walker, Mr. and Mrs. James White, the Misses Wicksteed.

A VISIT TO HADFIELD'S STEEL FOUNDRY.

These works at the present time cover 80 acres in extent, the foundry being the largest steel foundry in the world. It is 1,020 feet long; in addition to which there are the machine shops, with an area of 124,690 square feet, and other large shops.

The Hecla Works of the company, which are situated at Attercliffe, are now used principally in the production of projectiles, of which Hadfield's are very important manufacturers.

In addition to projectiles, the company manufacture steel castings and forgings for all branches of mining and engineering work; and to meet the demands of their customers, the East Hecla Works are set apart specially to deal with the manufacture of steel requisites for collieries and mines, locomotive and rolling stock requisites, general engineering castings, hydraulic cylinders, up to 27 feet in length, marine castings, dredger castings, railway and tramway points and crossings, including the construction of special work for junctions, crossovers, etc.; complete crushing, elevating, and conveying machinery.

For many years Messrs. Hadfield's have enjoyed a world-wide reputation for the superiority of their castings, and have done an exceedingly large business in the wearing parts of crushing machines, these parts being made of Hadfield's Patent "Era" manganese steel, of which Mr. Hadfield is the inventor and the company the sole manufacturers. The striking characteristic of "Era" manganese steel is its combination of extreme hardness and great toughness. It is so hard that it cannot be machined for ordinary use, and is of uniform hardness throughout its entire mass. In fact, it is the supreme material for resisting severe wear and tear; and amongst the many purposes for which it has been adopted, in no direction has it been more successful than when applied for the rims of road roller wheels, as it reduces the cost of maintenance to the least possible figure.

Hadfield's have always been inseparably associated with colliery and mining work of every description, and furnish all classes of castings incidental to this class of industry. Among the miscellanea may be mentioned wheels and axles fitted by Hadfield's special fast method; Rowbotham's self-oiling wheels and axles, colliery tubs fitted up complete, patent appliances, such as Sylvester's prop withdrawer; tub greaser, tub controller, and pedestal and guard. The company also manufacture all kinds of steel for mining and quarry work, amongst which may be mentioned Hadfield's special cut-quick tool steel, patent "Heclon" mining drill steel, and patent "Hecla" tool steel, for ordinary turning tools.

Messrs. Hadfield also supply complete crushing, elevating, and conveyor plants.

In the Hadfield crushers it will be noticed that the defects existing in breakers of similar types have been abolished. Great improvements have been introduced, inasmuch as the frames, instead of being of ponderous cast-iron are of patent construction in the Hadfield solid cast-steel, and as the breaking strain of steel is almost six times greater than cast iron, the whole machine is much lighter than any other in the market. This latter advantage is of paramount importance when the cost of transport has to be taken into consideration.

The machines produced by Messrs. Hadfield's are about half the weight of similar sizes of like type in cast iron, but then they are three times the strength of the ordinary machines.

Next in importance to strength and durability is the cost of the up-keep of machines of this description, and it is a question that is often lost sight of when making comparisons in the prices of different makers' machines. In the Hadfield patent jaw crusher the cost of maintenance is reduced to a minimum. The jaw faces and the side cheeks are the parts that have to be most frequently renewed, and they are made of Hadfield's patent "Era" manganese steel.

The jaw faces are made of a patented design, and, whilst being of ample strength, they are much thinner than is permissible with chilled cast iron. Therefore, in this patent crusher the weight of the jaw faces and cost of renewals are reduced to a minimum. These are decided advantages over the ordinary type of machine, even where the Hadfield patent "Era" manganese steel is substituted for the thick and heavy chilled iron jaws, as, in order to properly fit the machine, the "Era" manganese steel jaws have to be made of the same depth, thus being much thicker than is necessary.

Space limit prevents us giving further information regarding Messrs. Hadfield's works and products, but we believe the remarkable prosperity of the company is primarily due to the personality of Mr. R. A. Hadfield, who has worked unremittingly to keep the vast establishment, of which he is the chief, in the foremost rank of industrial communities.—Journal of the British Society of Mining Students.

PERSONALS.

Horace Mayhew, president and promoter of the Cape Breton Coal, Iron and Railway Company, has resigned.

Mr. G. G. S. Lindsey, general manager of the Crow's Nest Pass Coal Company, and wife; Mr. C. J. R. Bethune, of Ottawa, and Mr. V. B. Wadsworth, of Toronto, have visited Victoria, B.C.

W. L. Austin, the New York metallurgist, who recently made an exhaustive examination of the Granby mines, completed an investigation of the B.C. Copper Co.'s Mother Lode mine recently.

Norman Fraser, manager of the Roche Percee mine at Estevan, has been appointed inspector of mines in the Province of Alberta. Mr. Fraser was formerly manager of a mine at Carbonado, Alta.

George W. Wooster, treasurer of the Granby Consolidated, has left the Boundary for a trip east, to visit his old home in Illinois, and to be present at the annual meeting of the company, in New York.

Mr. E. Drayton Grimke-Drayton, of London, Eng., Chairman of the Board of Directors of the Le Roi Milling & Mining Company, of Rossland, and Mr. A. J. McMillan, managing director, have paid the coast cities a visit.

Sigmund Rothschild, president of the Canadian Klondike Mining Company, operating at Bear Creek Dredge, Yukon, was in Winnipeg recently on his way to New York, to buy equipment for a general electrical plant to be used on the Yukon River next year.

Mr. R. Brown has resigned from the position of manager at the New Winnipeg Sydney No. 1, of the Nova Scotia Steel & Coal Co. There will be no filling of the position meantime. Mr. J. Johnston in addition to his other duties will undertake oversight of No. 1.

Many will regret to learn of the death of Mr. John McFee, of Belleville, Ont. He died on September 22nd, after a long illness. Mr. McFee, who was born in Glasgow, Scotland, sixty-three years ago, came to Canada with his parents, who located in Galt, whence he came to Belleville over forty years ago. A few years later he engaged in gold mining in North Hastings and was successful in his venture. Some years later he returned to Belleville and had since resided there. His wife died two years ago. Three daughters and two sons survive hnm.

Mr. Philip Ferdinand Kobbe, director and assistant secretary of the Westinghouse Electric & Mfg. Company, died at his summer home at Stockbridge, Mass., on Friday, September 21st, aged 64 years. Mr. Kobbe was one of the pioneers in the electrical business, his efforts always having been devoted to the financial end. In 1883 he was elected treasurer of the United States Electric Lighting Company, which position he held until 1890, when the United States Electric Lighting Company was absorbed by the Westinghouse Electric & Mfg. Company, at which time Mr. Kobbe was made treasurer of the latter company. In 1896 Mr. Kobbe was made vice-president in addition to his duties as treasurer, and in 1902 he became a director of the company.

MINING NOTES.

NEWFOUNDLAND.

Engineer Powell, of the Reid Co., has gone on a cruise along Canadian Labrador, in the S.S. "Dart," prospecting for minerals. It is said that there are some valuable deposits along the coast.

The recent statements in the press that work had ceased at Baie Verte and Betts Cove and that that these mines were being abandoned are not correct. The shut down is only temporary. These mines, and that at Pilley's Island, have been worked by American capitalists incorporated as the Newfoundland Syndicate. It spent a large sum last season also in exploring the old Little Bay mine, but operations there have been abandoned as no sufficient indications of ore were found to warrant further outlay. At Baie Verte work has been shut down until next spring and at Betts Cove work underground is suspended but exploration and development on other parts of the property will go on. At Pilley's Island work is proceeding as usual but, as soon as the shipping of ore is completed, underground work will be confined to development. This temporary curtailment is due to difficulty connected with the treatment of the ores and not to any want of faith in the properties. Besides sulphur the pyrites ore handled by the syndicate contains iron, copper and a small value in gold. The sulphur is roasted from the ore without difficulty, but there has always been trouble in the resulting cinder, which contains the iron, copper and gold. Some time ago the syndicate secured patents in the United States for an improved process for treating the cinder which called for the erection of expensive reduction plants. One of these is located near Jersey City and will soon be ready for work. The other is being erected at Pittsburg, but has been delayed by a labor strike, during which the buildings were dynamited and wrecked. Consequently a large stock of cinder has accumulated and is still accumulating from the ore now being shipped, which means the locking up of just so much capital. The sulphur does not cover operating expenses and the syndicate has decided to confine operations during next winter to developing the different properties pending the completion of its reduction plants. This will mean that a much smaller number of men will be employed in the mines the coming winter, but the syndicate has no doubt as to the ultimate success of its operations in Newfoundland and as soon as its new plants are running smoothly, mining will be resumed on the former scale.

COBALT.

In order to expedite and facilitate operation at the Columbus Cobalt silver mines the manager is now installing a complete steam power plant, consisting of boiler, steam drills, pumps and air blower, with a complete outfit for rapid mining. White sinking the big shaft, at 52 feet deep, a blind cross vein running out at right angle from the big main vein was discovered.

Some idea of the enormous interest that has been aroused in Ontario by the rich mineral discoveries in the Cobalt district may be gathered from the fact that during the months of April, May and June something like fifty companies were formed, with an aggregate capitalization of $32,000,000, to exploit the mineral resources of the new mining area.

Prof. Hidden, the American geologist, is of the opinion there is no doubt of the so-called permanency of the camp, that is, the ore will be found at great depths. Under similar conditions in Germany the ore is being successfully mined at depths of 1,500 and 2,000 feet. Other mining men in camp will not risk their reputations as to the continuation with depth of any particular deposit.

Prof. Manley B. Baker, of the School of Mining, who has returned after acting as Government Inspector at Cobalt for the past four months, states that when prospectors and capitalists became aware of the object of the inspection, they were perfectly satisfied. "The real prospector, the real mining investor and the better class of people in the district are all satisfied with the new system," he said. Professor Baker looks for deep working mines in future.

G. Parry Jenkins and H. Barnard have returned from the gold fields of Northern Ontario, where the recent find has been made on Larder Lake. Notwithstanding the secrecy with which this find has been guarded, a large number of prospectors have crept in, with the result that a very large area of the gold-bearing ridge has been staked, extending probably four miles along the north shore of the lake, by two miles or more back.

Hon. Geo. T. Baird, Senator, of Andover, Victoria county, N.B., has been in New Ontario since the closing of Parliament in early July, and has his face now turned homeward for the first time since that event. In the meantime, with a reliable force of picked men, taken from New Brunswick, he has been prospecting the Cobalt district, and while he speaks quite moderately of his success, there are rumors that he is the owner of some valuable property in the silver region.

Rich ore has been found in a crosscut of the 300-foot level of the Timmins mine. This is thought to have an important bearing on the question of the permanency of the camp deposits with depth. Most of the mining in the Cobalt region, so far, has been on the surface, that is to say, few shafts are down over 50 or 60 feet. The 200-foot level of the Timmins mine showed the vein wider than and just as rich as on the surface, and this discovery on the 300-foot level, therefore, means much.

Superintendent McMillan, of the Foster mine, states he has seven car loads of ore that he expects will run from $20,000 to $35,000 a car load stored and ready to ship. The mine is now being actively worked though in primitive fashion. The ore shipped last fall realized about $50,000. A. W. Scott, of Pioche, Nevada, a mine manager of experience, is now in charge, putting a larger force at work and arranging for the installation of the necessary machinery. Mr. Scott was brought from Nevada to examine the property. As soon as he saw it he invested and was induced to take the management. The mining engineer in charge, F. C. Loring, says $700,000 is already blocked out, and ready for extraction. The Foster mine is in the south belt, adjoining the Lawson, the Jacobs and the Drummond mines, all very rich properties.

The Temiskaming & Northern Ontario Railway Commission have made a new deal for the right of way mining claims in the Cobalt district, in place of the deal with the Ottawa syndicate. Of the original syndicate only Messrs. J. P. Dickson, A. W. Fraser and T. A. Bement are included in the new one. The other members are Messrs. J. G. Turriff, M.P., Edmund Seybold and George Goodwin, contractor. The negotiations were with Messrs. Bement and Dickson. The terms of the new deal are exactly the same as the former ones. These terms were better than the advertisements had called for. The syndicate is to pay a royalty of $50,000 and a flat rate of 25 per cent. on the ore taken out of the mines. The original advertisement provided for payment of a $50,000 royalty, 10 per cent. on ores assaying less than $400 gross value a ton at the mouth of the mine, 25 per cent. on ore assaying $400 and up to $1,000 per ton, and 50 per cent. on ore assaying over $1,000.

The first thing I noticed about Cobalt on revisiting it after an absence of five months is that the town itself has become quite sobered up, writes Mr. Wallace Maclean, special correspondent of the Globe. Last spring the evidences of intoxication were visible on all sides. Scores of abandoned foundations and half-built, rickety shacks remain to remind one of the wild dreams of the townspeople but the business part of the town has now become well-defined, being centered around the public square, while the town has got well rid of a more or less numerous collection of boomers and fakirs. Cobalt is becoming —it almost has become—a purely local camp, identical with the other towns along the line of the T. & N. O. Railway. Cobalt has become a working camp exclusively, and its growth henceforth will be in direct proportion to the growth of the mines that surround it. It is perhaps a good thing for the town that the speculative boom of last summer did not materialize as expected. The business men of Cobalt are well satisfied with the progress that has been made. More men are at work, more genuine mining is going on, and more goods are being consumed than at any previous time in the history of the camp. And everyone is optimistic of the future. It is anticipated that before long a couple of thousand men or more will be employed at the mines surrounding the town. It seems almost certain that Cobalt will become one of the most important mining camps of the country. The speculative end of the Cobalt camp has shifted from the camp itself to Toronto and New York. The excitement that was anticipated in Cobalt last spring is due to reach Toronto and New York this fall. The preliminary symptoms are observable already in these two cities, and a wild flurry may set in at any moment. Cobalt still remains a very indefinite proposition. It is hard to form any definite idea of the wealth of the mines. There are no precedents for determining values.

ONTARIO.

At the Laurentian mine, in the Manitou, the shaft is now down to a depth of 272 feet, with drifts at the 80-foot and 200 foot levels. These drifts are being made primarily to establish the extent of the rich ore shoot. At the 80-foot level it was encountered and 30 feet of good ore passed through. An upraise was then made for fifty feet, and drifting towards the shaft is being made from that point.

A new mining district has been constituted on the recommendation of the Minister of Lands, Forests and Mines.

It embraces the districts of Parry Sound and Muskoka, exclusive of the islands lying west of these districts in Georgian Bay. It will be known as the Parry Sound District, and Henry F. McGuire has been appointed mining recorder at a salary of $500. The head office will be at Parry Sound.

Charles W. Belyea has been appointed recorder of the Kenora Mining Division with head office at Kenora; salary, $500.

Four mining leases have been cancelled for default, one each in Nipissing and Algoma, and two in Rainy River North.

BRITISH COLUMBIA.

The recorder's office at Conrad is working over time issuing grants for properties in the Wheaton, Watson and Mill Haven districts.

Two of the new furnaces have been installed at the B.C. Copper Co.'s smelter, and smelting operations, after many unforeseen delays have been resumed.

The Northern Mines Limited, on Spruce Creek, have closed down their steam shovel. Several liens have been fyled against the company, which may account for the shut down.

The main shaft at the Crescent mine is now down to a depth of 155 feet, and will be continued to the 200-foot level. An order will soon be placed for an air compressor for the property.

The first payment, amounting to $3,000, has been made by the Dominion Copper Company on its option of the Gloucester group of claims in the Boundary districts of British Columbia.

An assay of ore sent to Baker & Co., of Newark, N.J., by McRae Bros., owners of the Hamilton claim, Kennedy Mountain, Similkameen, returns 60 ounces in platinum per ton and 28 per cent. copper.

The Vault, near Conrad, is looking better every day and with the completion of the tram this month it will also be a regular shipper. Ore is coming down via the Montana tramway every day from the Big Thing and is being shipped from the company's dock.

The forty-two foot ore shoot which was shown to the members of the Canadian Civil Engineer's Association, who visited the Centre Star recently, and which was advertised at the Nelson fair by two large pieces of the ore, is probably the most important find that has yet been made in the Centre Star mine.

In the north drift in the lower tunnel at the Venus, on Windy Arm, the best ore yet encountered is being taken out, showing that the vein in the lower tunnel is richer and larger than in the upper tunnel, and proving beyond a doubt that the Venus is a real mine and will continue to ship ore steadily from this time on.

The latest report from the manager of the Cariboo Consolidated says:—"During August, washed 501 cubic yards of gravel, yielding 87 oz. of gold. Have just struck very rich gravel, drive 2 E, 17 cubic yards of gravel, yielding 19 ozs. of gold. The width of the pay streak is 50 feet. Exceedingly wet; must be drained before working on a large scale; prospects are grand.

The Atlin Consolidated Mining Co., whose steam shovel and electric dump car system has been in operation on Tar flats since July, has had their first clean-up and the amount of gold obtained was very satisfactory. The company's shovel is now working to good advantage and the yardage moved is daily being increased. It is hoped to soon be able to handle 2,000 yards in 24 hours.

The copper vein on the Britannia property on Howe Sound has been cross-cut in the Mammoth Bluff tunnel, and the expectations of the officers of the company are realized. It means that the vein runs consecutively through the whole of the claims comprising the property. The lead has been traced a distance of 9,000 feet, nearly two miles, and averages about thirty feet in width.

It was because the vein was present in the Jane claim that the management determined to undertake work involving an expenditure of a million dollars.

"Zinc," says G. O. Buchanan, the well known president of the Associated Boards of Trade of the Nelson district, "is now in about the same position as was lead a few years ago, before the bounty was granted by the Dominion Government. It is languishing. The market is uncertain, the 20 per cent. duty imposed by the United States Government is operating against producers and the unfinished condition of the new zinc smelter at Frank, which works will probably absorb a quarter of a million dollars to put upon a fair working basis, is not encouraging.

A rich quartz strike has been made eight miles from Log Cabin, on Too-Chi Lake. Fifteen claims were staked and have been bonded to New York capitalists. The whole country will soon be covered with stakes. A town-site has been located at the head of Too-Chi Lake. It is quite possible that the White Pass Railway will build a branch road to Conrad City by way of Too-Chi Lake to tap both on these rich camps. The ore in the vicinity of Too-Chi Lake carries value in gold, silver and copper. Surface assays show $25 to $40 per ton value in the three metals. A government road will be built from Log Cabin to the mines.

YUKON.

One hundred and one ounces of gold, worth $1,616, taken out in three days by seven men is the result of a clean-up made in the Yukon on the hillside claim on the right limit of Hunker, opposite No. 26 below. The claim is owned by Messrs. McLeod and McLaughlin. This is among the richest pay ever struck in the Klondike.

In the course of an interview given in Victoria a few days ago, Mr. J. H. Rogers, traffic manager of the White Pass & Yukon Railway, stated that, although the pick and shovel have given way to gigantic dredges in the Yukon, Dawson will continue in its present prosperity. Five dredges are already working in the district; one on Bear Creek, owned by the Rothschilds; the Bonanza Basin Company's dredge now working on the lower Klondike; the Ogilvie dredge built for the Stewart River, but now working on the lower Klondike; the original Klondike dredge built by the Lewis River Gold Mining & Dredging Company, and the Canadian Forty-mile dredge owned by a Toronto syndicate, headed by Dr. Grant and W. J. Smith.

The Guggenheims are now assembling three dredges for work next season. Two of these will be located on 104 below on Bonanza, and the other on 90 below on the same creek. A dredge for Col. Budd and Russell King is now on its way down river to Dawson. It will be taken to the mouth of Forty-mile and hauled up that stream to American territory. The Allen dredge, also for the American end of the Forty-mile, was shipped the other day on the steamer "Al-Ki." Mr. Rogers states that at least five other dredges, apart from others the Guggenheims are likely to build, will be sent north next season.

COAL NOTES.

NOVA SCOTIA.

Shipments of the Springhill collieries, of the Cumberland Railway and Coal Company, during August amounted to 32,145 tons.

The approximate output of the Dominion Coal Companies collieries at Glace Bay, during September was 23,800 tons. Shipments were approximately 33,300 tons.

The Dominion Iron & Steel Co. have received a cargo of Gowrie coal for use in their blast furnaces. The latest analysis of this coal shows it to be well adapted for metallurgical purposes, and an excellent steam coal besides. The Dominion Steel Co., it is said, are making a practical test of this coal with the view of purchasing the entire output of the Morien collieries.

A new bank head will be erected at the Reserve mine, Dominion Coal Company, Glace Bay. The new structure will be slightly higher than the old one and will be built of hard pine. Construction work on this will be rushed with all possible expedition. The new bankhead will serve the French and East slopes and also the Emery seam. No more steel bank heads will be built by the Dominion Coal Co. Hard pine proves nearly as durable in Cape Breton and in cases where wood is used in building any changes or alterations needed can at any time be readily made.

Excellent progress is reported from the mine now being developed at Port Malcolm. About a hundred men are at present employed there and a shaft has been sunk to the depth of 325 feet; at a distance of 75 feet lower down it is expected that the principal seam of coal will be struck. The company are now reported to have seams 4, 6, 7 and 12 feet in thickness respectively. A peculiar feature of the seams here near the surface is the fact that they run perpendicular or nearly so. It is expected, however, that at a greater depth the coal will take a turn and the seams will be at a favorable angle for working operations. Tunnels are being driven from various points in the shaft. The full size of the coal basin is not determined but work is being carried on to determine accurately its extent which is believed to be great. The industrial development is making itself felt in Richmond County.

In connection with the report that negotiations are going forward looking to the merging of all the coal interests in Cape Breton, held outside the areas of the Dominion Coal Company, coupled with which the names of Henry M. Whitney, B. F. Pearson and Graham Fraser are mentioned, it can be said that Messrs. Pearson and Fraser have just visited Glace Bay and Fort Morien, and it is stated that the proposed amalgation is likely to be completed within a very short time.

The properties held outside those owned by the Dominion Coal Company include such well-known areas as those of the Gowrie and Blockhouse collieries, the North Atlantic Collieries Company, areas at False Bay Beach owned by Gen. Montgomery Moore, the property of the Cape Breton Coal, Iron and Railway Company at Broughton, areas of the Cumberland Coal and Railway Company, and other minor holdings, including submarine areas.

The project will involve a capital of several million dollars.

The proposal is to ship the product of the combined areas at Port Morien, and eventually to build a railroad to Louisbourg for winter shipments.

Surveys are now being made of some of the properties, which, it is said, will be taken over in the deal.

BRITISH COLUMBIA.

Coal properties in the neighborhood of Coulti, in the Nicola Valley, have been bonded to the extent of $100,000, the Diamond Vale Coal and Iron Mines, with head offices in Vancouver, being responsible for the deal. Sir Thomas Shaughnessy is reported to have said that the C.P.R. Company would take all the coal the Diamond Vale people could turn out. The Diamond Vale Company is composed largely of British Columbians.

Some idea of the increase in traffic that has taken place during the past year on western lines of the Canadian Pacific may be gleaned from the statement that so far this season approximately 75,000 tons more of bituminous coal have been received for the railway company at Fort William than had been unloaded here at this time a year ago. Since the opening of navigation 268,482 tons of soft coal—nearly 50 cargoes—have come across the lakes, as compared with about 190,000 tons for a similar period in 1905. It is estimated that between 150,000 and 200,000 tons more of soft coal will have been received at this port for the company before the close of navigation than were handled last season, and nearly double the amount used in 1904. Their contract calls for 450,000 tons, and they have secured an option on an additional 100,000 tons, which will be delivered if a sufficient number of bottoms can be secured. The total amount used last year was 316,000 tons.

Of anthracite, most of which is consigned to Winnipeg merchants, about 45,000 tons have already arrived, and fully 10,000 tons are yet to come. Less than 50,000 tons were unloaded here in 1905.

During the season one record in the coal handling trade was broken. The steamer "Stanton" on her last trip up took 10,200 tons, the largest cargo by 600 tons that ever arrived at the head of Canadian lake navigation.

THE MINING AND INDUSTRIAL SHARE MARKET.

(Specially reported for the CANADIAN MINING REVIEW by ROBERT MEREDITH & Co., Mining Brokers, 57 St. François Xavier St., Montreal.)

Almost the entire interest in mining stocks is centered in the Cobalt companies. Several of them are being traded in on the "curb" market in New York, where there is the wildest kind of speculation. Prices are fluctuating widely, and soaring without any apparent cause except the tips given out by the promoters.

In the far West there has not been so much trading, but prices are firm, and the low priced stocks are being accumulated by Westerners.

The principal advance has been in California, Giant and Novelty, in the Rossland Camp. These properties are contiguous to the Le Roi No. 2 mine, and the buying has been stimulated by a report that efforts are being made to bring about a combination.

The market for the industrial shares is irregular, trading is very light, and there is almost an entire absence of speculation in these securities.

Coal stocks are somewhat lower, but the iron are higher, due probably to the high price prevailing in the metal trade.

The latest quotations are as follows:—

	Bid.	Asked.
Consolidated Mines	147½	150
Can. Gold Fields	7	7½
Granby Consolidated	14¾	15
Rambler-Cariboo	28	30
North Star	24	26
Monte Christo	3	3½
White Bear	9	10
California	6	7
Virginia	5	6
Deer Trail	...	2½
International Coal	57½	60
Sullivan	10½	13½
Jumbo	25	26
Cariboo-McKinney	3	4
Denoro	7	8
Novelty	2½	3
Diamond Vale Coal	17	20
Dominion Copper	6	6⅛
Dominion Coal (com.)	69	70
Dominion Coal (pref.)	...	...
Dominion Iron & Steel (com.)	29¼	29¾
Dominion Iron & Steel (pref.)	78½	81
Intercolonial Coal (com.)	...	...
Intercolonial Coal (pref.)	...	...
Nova Scotia Steel & Coal	67½	70
Nova Scotia Steel & Coal (pref.)	...	...

COMPANY NOTES.

The annual meeting of the stockholders of Allis-Chalmers Company, of Milwaukee, Wisconsin, represented in Canada by the Allis-Chalmers, Bullock & Co., of Montreal, held in Jersey City, September 6th, was marked by an unusually large attendance, more than sixty-five per cent. of the entire capital stock having been represented. The general feeling of harmony and satisfaction that prevailed in support of the present administration was particularly noteworthy. The re-election of Mr. W. H. Whiteside to the presidency, and his election to the directory to fill the longest term in the gift of the company, assures a continuance of his aggressive policy and will eliminate any feeling of uncertainty for some years to come.

In the following unanimous resolution the feeling of satisfaction felt by the stockholders is strongly expressed:

Resolved: "That the stockholders in annual meeting assembled express their appreciation of the services of President Whiteside and assure him of their cordial support for the ensuing year."

It is noticeable that the company has secured about $4,500,000 worth of orders for classes of machinery not hitherto manufactured by this company, and this amount would have been very largely augmented had the completion of the improvements and extensions of the West Allis plant not been delayed by the labor troubles to which the contractors erecting the new buildings have been subjected. Notwithstanding the fact that the volume of orders taken for Allis-Chalmers steam turbines has been beyond all expectation, the demand for Reynolds Corliss engines also shows an unprecedented increase over preceding years.

In the electrical field the large orders received have hastened the occupancy of the new shops at West Allis provided for this branch of the business, which, in spite of their unfinished condition, are already in partial operation. Some of the largest corporations in the country have awarded the Allis-Chalmers Company contracts for their complete power and electrical equipments, thus endorsing President Whiteside's policy in providing the new departments established during the past year, which now enables the Allis-Chalmers Company to take orders for complete installations and thereby save purchasers the losses and annoyance incident to the division of responsibility in the erection and operation thereof.

The acquisition by the company of the Christensen Air Brake and Compressor patents rounds out the list of products required to enable the Allis-Chalmers Company to enter the electric railway field fully equipped for that service.

INDUSTRIAL NOTES.

The Bell Asbestos Mines, of Thetford Mines, Que., and the Asbestos Mining & Mfg. Co., of Chrysotile, Que., have recently increased their hoisting plants, the former by the addition of three and the latter by the addition of two 9 x 13 special cableway hoisting engines, as built by The Jenckes Machine Co., Limited, of Sherbrooke, Que.

The Canadian Consolidated Mines at Trail, B.C., have found by careful comparison that the use of Westinghouse electrical apparatus for power and haulage actually increases the output of their mines, and at the same time cuts down their operating expenses. They are now using three Westinghouse 1,250 K.W. transformers, as well as a Westinghouse electric locomotive for hauling cars to and from the mines.

The Montreal Smelting & Refining Co., which is building an extensive customs smelter at Trout Lake, near North Bay, Ont., for treatment of Cobalt ores, has closed a contract with The Jenckes Machine Co., Limited, Toronto, for the complete steam plant which will be required. This will consist of four 150 H.P. high pressure tubular boilers, two 250 H.P. heavy duty Corliss engines with feed water heater and boiler feed pump. The boilers are being built at the St. Catharines Works of the Jenckes Company and the balance at Sherbrooke.

The Ontario Power Company, which operates on the Canadian side of Niagara Falls, recently decided upon an enlargement of its power house capacity and contracted with the Westinghouse Electric & Mfg. Company for two of the largest power generators ever turned out at East Pittsburg. These machines are of 10,000 H.P. each and are called water-wheel generators. The Power Company has already installed four machines of a similar type, which were also furnished by the Westinghouse people. This last contract includes switchboard appliances. The additional power apparatus was made necessary by the great demand for electrical energy to operate manufacturing plants in the company's territory.

The Yukon Consolidated Goldfields Company, Limited, have contracted with the Canadian Westinghouse Company for the following electrical apparatus to be used in gold dredging in the Yukon Territory:—Three 100 H.P. 3-phase, 60 cycles, 400 volts, type F motors; three 15 H.P. 3-phase, 60 cycles, 400 volts, type F motors; three 50 H.P., 850 r.p.m., 3-phase, 60 cycles, 400 volts, constant speed induction motors; three 30 H.P. motors; three 20 H.P., 1,120 r.p.m. motors; three 15 H.P. 850 r.p.m. motors; three 7½ H.P., 1,700 r.p.m. motors; nine 75 K.W., oil insulated, self-cooling transformers; two 625 K.W., 3-phase, 60 cycles, 2,200 volts, 415 r.p.m., A.C. generators, and two 17 K.W., type S exciters for same; one 4 panel switchboard for controlling above; four 250 K.W., oil-insulated, oil-cooled transformers and four 200 K.W. transformers, same type.

The Allis-Chalmers Company is about to issue Bulletin No. 1415 on its Style "D" rock and ore breakers. This publication enters very fully into details of construction and contains much information which will be found of value by contractors, road builders, quarrymen, owners of ore reduction works, operators of rock crushing plants, and others interested in affiliated industries.

In the year 1885 the gyratory form of rock and ore breaker was finally developed into an entire success, after more than ten years of costly experimenting. No machine ever wrought a more complete revolution than did the gyratory breaker in the field of rock and ore breaking, supplanting to a large extent, as it did, the jaw breaker type, and opening up new fields of industry.

The Gates rock and ore breaker has been constantly improved from year to year in design, workmanship and material. These improvements have increased its capacity and longevity, added to its facility of operation and maintenance, and decreased the power required to crush a given quantity of rock.

Although these breakers are of necessity subjected to the severest tests of strength and durability, it is worthy of note that many of the original machines, now nearly a quarter of a century old, are still in active operation.

The Montreal Light, Heat & Power Company have recently contracted with the Canadian Westinghouse Company, Ltd., for a large addition to their power equipment. The apparatus contracted for is for their new Soulanges Canal power station on the St. Lawrence River. The equipment consists of three Westinghouse 3750 K.W. revolving field alternating current, two-bearing generators connected to water turbines. These generators are 7200 alternations, 4000 volts, three-phase, operating at 225 revolutions per minute. There are also two Westinghouse 150 K.W. direct current 125 volt exciter units. Westinghouse 2500 K.W. oil-insulated, water-cooled transformers to the number of thirteen are an important part of the equipment. Seven of these transformers will be used for raising the voltage at their generating station from 4000 to 44,000 volts, and six of them will be used at the lowering end of the transmission line, stepping down the voltage from 44,000 to 12,000.

The generators and exciters will be controlled by motor-operated rheostats and the complete switchboard apparatus, which the Canadian Westinghouse Company are furnishing for both the main and sub-stations, will involve the latest type of electrical control, representing the highest development of switchboard apparatus.

This contract is among the largest recently placed in the Canadian field, and the fact that it was awarded to the Canadian Westinghouse Company after the sharpest competition, speaks well for the estimation in which Westinghouse apparatus is held by large power users.

The merits of the Allis-Chalmers Steam Shovel, in design and construction, have been well attested in the number of orders received for shovels of various sizes and for shipment to various parts of the country.

Four seventy-ton shovels have recently been ordered for the Savannah, Ga., district by H. L. Pierce and the Electric Phosphate Company, one shovel each, and the Prairie Pebble Phosphate Company, which has two shovels on order. The Dunnellon Phosphate Company of Rockwell, Fla., has contracted for two 40-ton shovels.

The Toronto Construction Company, through the Canadian representatives of Allis-Chalmers Company, has ordered a 70-ton shovel for use in Canada. This shovel is to be built after designs which are peculiarly Allis-Chalmers and with the following characteristics:—

Weight	70 tons.
Capacity of dipper, struck measure	2½ yds.
Height of point of boom above rail	26 ft. 2 in.
Height of frame	19 ft. 1 in.
Clear height of lift	17 ft. 10 in.
Reach below rail	3 ft. 6 in.
Width of cut at 8 ft. elevation	54 ft. 6 in.
Gauge of track	4 ft. 8½ in.

Capacity 2,000 to 3,000 cu. yards per ten hours.

The hoisting engines are 12 in. x 12 in. of the link reverse type, direct geared to hoist drums. The swinging and thrusting engines are 7½ in. x 7½ in., reversing Duplex type.

The boiler is of the locomotive fire box type, 54 in. in diameter and 13 ft. 6 in. long, built for 140 lbs. working pressure.

The car is 9 ft. 8 in. wide and 40 ft. 11 in. long over all. The trucks are of the steel diamond pattern of the Master Car Builders. The draft rigging is equipped with tower automatic couplers and two link bar chains to drive both forward and rear trucks. A steel water tank, containing 1,100 gallons, completes the equipment.

MINING INCORPORATIONS.

NEW BRUNSWICK.

The Rothwell Coal Company, Limited. Head office, St. John, N.B. Capital, $12,000, in twelve thousand shares of $1.00 each. Incorporators: Hammond J. Evans, Minto, N.B.; E. G. Evans, of Hempton, N.B.; Gilbert C. Jordan, St. John, N.B.; Dr. H. B. Hay, Chipman, N.B.; Hugh Wilson, of Coal Crcek and James L. McAvity, Fredericton, N.B.

QUEBEC.

Megadyne, Limited. Capital, $250,000, divided into two thousand five hundred shares of one hundred dollars each. Head office, Montreal. Incorporators: Charles A. Barnard, Casimir Dessaulles, Romuald Roy, Charles A. Sara and William F. Sharswood, all of Montreal.

The Montreal Reduction and Smelting Company of Canada, Limited. Capital, $2,000,000 in 400,000 shares of $5.00 each. Head office, 26 St. James street, Montreal. President, J. E. E. Leonard; vice-president and managing director, J. H. Brown; treasurer, B. Burland; secretary, L. J. Carter.

The Milton Hersey Company, Limited. Capital, $40,000, divided into four hundred shares of one hundred dollars each. Head office, Montreal, Que. Incorporators: Milton Lewis Hersey, Montreal; Thomas S. Gladding, New York; Charles Ryerse Hazen, Cleveland, Ohio; Charles Henry Lester, Percy Carroll Ryan, Alfred T. Bazin and Joel Bennet Saxe, all of Montreal.

ONTARIO.

The Wright Silver Mining Company, capital, $200,000. Incorporators: Thos. Horder, F. C. Elks, Annie E. Lloyd, E. B. Ryckman and C. C. Robinson.

The Canada Mines Company, capital, $1,000,000. Incorporators: H. C. Barber, Margaret Cairncross, James A. Gormaly, R. T. Shiell, H. L. Dunn, of Toronto.

The British-American Silver Co., capital, $50,000. Incorporators: Dr. Jno. E. Elliott, Wm. H. Wallbridge, Fred. Smith, Joseph E. Davies, and Harold N. Baker.

McWilliams Copper Mining Company, capital, $100,000. Incorporators: J. F. Lennox, D. A. Rose, F. W. Rose, Mildred W. Mayor, and G. T. Veale, of Toronto.

The Rochester Mining Company, Limited. Capital, $40,000, divided into forty thousand shares of $1.00 each. Head office, Toronto, Ont Provisional directors to be Ziba Gallagher, Ethel Maud Wilson and Helena May English.

The Twin Lake Mining Company, Limited. Capital, $500,000, divided into shares of $1.00 each. Head office, New Liskeard, Ont. Incorporators: W. J. Spencer, George Alexander, M. Gaughery, both of North Bay, Ont., and John Juby and H. Darrow, of New Liskeard, Ont.

The Interprovincial Mining Company, Limited. Head office, Haileybury, Ont. Capital, $1,500,000, divided into one million five hundred shares of $1.00 each. Incorporators: W. A. Weir, K.C.; J. A. Ewing, Montreal; Alex. Lay, T. H. Steele, both of Haileybury, and J. J. Labrosse, of Hawkesbury East.

The Golden Reed Mining Company, Limited. Head office, Sault Ste Marie. Capital, $1,200,000, divided into one million two hundred thousand shares of $1.00 each. Incorporators: R. J. Miller, St. Thomas; George Reed, Michipicoten; Merizo Gates and Albert Edward Sharpe, both of Sault Ste Marie, and F. M. Dole, of the same place.

The Canadian Coal and Navigation Company, Limited. Capital, $500,000, divided into five thousand shares of one hundred dollars each. Head office, Tillsonburg, Ont. Provisional directors: Eli Chadwick Jackson, George Whiting Tillson, Victor Albert Sinclair, Edwin Van Norman Tillson, Spence Hardy Betts and Charles Hamilton Denton.

The Huronian-Cobalt Silver Mining Company. Capital, $500,000, divided into five hundred thousand shares of one dollar each. Head office, Parry Sound, Ont. Incorporators: C. H. Phillips, G. G. Gladman, W. J. Beatty, A. B. Begg, J. R. Stone, W. L. Haight, George Moore, Alexander Logan, and James Caldar, all of Parry Sound; H. A. Agrar, and A. R. Smith, of Burk's Falls; J. J. Anderson, of Novar; J. Livering, of Coldwater and John F. Lennox, of Cobalt.

BRITISH COLUMBIA.

The Elk Valley Coal Company, Limited. Capital, $200,000, divided into two hundred thousand shares of $1.00 each.

The Bonanza Mining and Milling Company, Limited. Capital, $1,000,000, divided into one million shares of $1.00 each.

The Kootenay Amalgamated Oil and Coal Company, Limited. Capital, $1,000,000, in one million shares of $1.00 each.

The American Boy Mining Company. Capital, $150,000, divided into one million five hundred thousand shares of 10 cents each. Head office, Kaslo, B.C. W. E. Zwichey, attorney.

CATALOGUES.

The following catalogues have been received:—

The Year Book of the Michigan College of Mines, 1905-1906, Houghton, Michigan.

Stamp Milling Machinery, published by the Traylor Engineering Company, New York, U.S.A. (Catalogue I.)

Bulletin A. Lombard—Replogle Water Wheel Governors, Lombard-Replogle Engineering Co. Akron, Ohio, U.S.A.

Bulletin No. 132, Medium Speed Automatic Four-Valve Engines, published by the Allas Engine Works, Indianapolis, U.S.A.

The Blaisdell System of Automatic Cyaniding Machinery. Catalogue F, published by the Blaisdell Company, Los Angeles, Cal., U.S.A.

Mining and Quarry Cars, Ships and Buckets, published by the Allis-Chalmers Co., Chicago, Ill. (Represented in Canada by the Allis-Chalmers-Bullock Co., Ltd., of Montreal). Catalogue No. 17, sixth edition.

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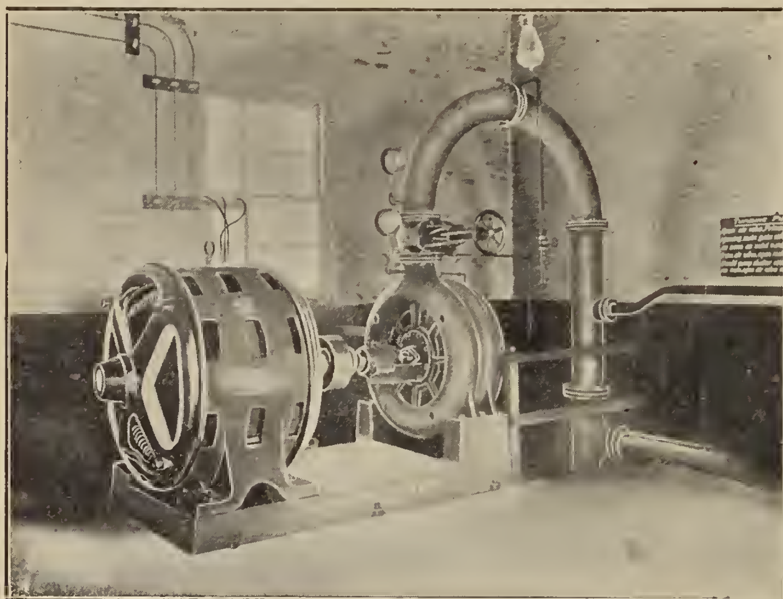
W. W. CORY,

Deputy of the Minister of the Interior.



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24th YEAR OF PUBLICATION

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Alfred W. Dyer, Nelson.

CONTENTS.

During the past summer Mr. E. Lindeman, of the Mines Branch, has made magnetic surveys of the Glendover iron range, Ontario, and of an iron range near Bathurst, N.B.

We are informed that the Federal Government has promised a subsidy of $6,400 a mile for the first hundred miles of railway built north from Roberval toward Chibougamau, and that the Quebec Government has pledged itself to a land grant of 7,000 acres per mile for the same length of road.

The catalogue of the Geological Survey publication has heretofore, left to be desired, as the French say. No further reproach will, however, be possible, as a new catalogue has been issued that is a marvel of completeness and intelligent compilation. There are half a dozen different ways of getting what you need from it; if you don't know the number of the publication, you may possibly be aware of the author's name; if not, you may remember the year of the issue, or you may know the region to which it refers, and in any case you will run your quarry to earth by the aid of this invaluable little volume, which, by the way, has been compiled by Mr. W. P. Nicolas.

Another good thing has, seemingly, gone wrong. The wonderful gold discoveries that were reported from the Peace River, do not apparently exist. Mr. J. A. Macdonnell has written to the Toronto Globe, saying that the samples he brought down with him had been given to the Department of Mines for assay and had been found worthless. Once more we have iron pyrites mistaken for gold, though the tests are so simple that one would have thought that some of the gentlemen connected with Mr. Macdonnell's survey, would have been able to detect the difference. We understand that Mr. Macdonnell claims to have got results of $5.70, $17 and $32 to the ton from some samples of ore that he procured upon the ground. We hope he was not mistaken, in which case there will certainly be another story to tell by this time next year.

The discovery of a large field of bituminous coal under the English Downs shows, that after more than eighteen centuries of prospecting, the end has not been reached in the British Isles. How long will it take to thoroughly prospect and develop the mineral wealth of the Dominion of Canada? The answer should surely run into astronomical figures. The truth is that we have as yet barely scratched the surfaces of a few of the more accessible districts. Mining schools and prospecting classes could be multiplied in Canada to our very great advantage. Meanwhile, the Ontario Government is doing something through its Summer Mining Classes, and we should like to see the other provinces follow the lead set by Ontario. The Geological Survey is doing grand work, but the tasks of the geologist and of the prospector are not identical; the former should point out to the latter where his work might begin, but you cannot expect a man who has to cover a district as large as an ordinary kingdom, in a summer, to do painstaking, detailed work, such as a prospector must do to be successful.

Judging by the reports brought down by the officers of the steamship Adventure, it seems probable that the Canadian and Grand Trunk Pacific Railways will carry most of the wheat from the prairie to the ocean for many a long day to come. The Hudson's Bay route does not seem an attractive one from the point of view of the ordinary shipmaster. Fort Churchill was reached on September 2nd, and it is said that a strong current runs through the river, and the vessel had to anchor a long way out from shore as the tides fall from 30 to 40 feet, leaving 1,500 feet of rock and sand bare at low water. The work of discharge was very slow ; 500 tons of cargo and 3,000 sacks of coal were put ashore. The weather was very stormy, so much so that at times the boats could not leave the ship. Two boats, which broke adrift from a lighter, were driven ashore and smashed. Two other boats attached to the stern of the steamer were sunk. The two gasolene launches were repeatedly injured by contact with the rocks. After this spell the weather suddenly changed, becoming cold with fierce snow storms, and, fearing to remain any longer, Captain Couch, of the Adventure, left on the 1st of October, with the balance of the coal, some 4,000 sacks. It was then freezing hard at night and six inches of snow lay on the ground. On the evening of October 3, the vessel passed through heavy Arctic ice, running strongly southward. The Adventure, however, scraped her way safely through. At Cape Chidley, on the 5th, the vessel encountered a strong gale of wind with thick snow, and this weather lasted all the way down the Labrador coast to Belle Isle, which was reached on Tuesday evening, October 9. The weather was mild but foggy for the remainder of the trip to St. Johns, Newfoundland.

The Mines Branch of the Department of the Interior under the direction of Dr. Eugene Haanel, Ph.D., has issued during the past few years a number of publications in addition to the annual reports. A great deal of very valuable work has been done in a quiet, unostentatious way, though, no doubt, most students of mining have kept themselves fairly well posted, and have managed to obtain copies of all the publications as they issued. In case, however, some of our readers have overlooked one or more of these reports, we would call their attention to the following list:—

"On the location and examination of magnetic ore deposits by magnetometric measurements."

Report on the Great Landslide at Frank, Alberta, 1903.

Report on the Mining Conditions in the Klondike, Y.T.

Preliminary report on the Limestones and the Lime Industry of Manitoba.

Preliminary report on the Industrial Value of the Clays and Shales of Manitoba.

Preliminary report on the raw materials, manufacture and uses of Hydraulic Cements in Manitoba.

Report on Mica, its occurrence, exploitation and uses.

Report on Asbestos, its occurrence, exploitation and uses.

Report of the Commission appointed to investigate the different electro-thermic processes for the smelting of iron ores and the making of steel in operation in Europe.

Preliminary report on the experiments conducted at Sault Ste. Marie, Ont., under Government auspices, in the smelting of Canadian iron ores by the electro-thermic process.

Report of the Commission appointed to investigate the Zinc Resources of British Columbia and the conditions affecting their exploitation.

Moreover, magnetic surveys have been made and maps constructed of the following magnetite deposits:

Baldwin Mine, Que.

Temagami Iron Range, Ont.

Calabogie Mine, Ont.

A revision of the iron ore deposits in Charlotte County, N.B.

Lot 7 A, Range V, Township of Leeds, Que.

Wilbur Mine, Township of Levant, County of Lanark.

The Belmont Iron Mine, Township of Cordova, Peterborough County.

We understand that a full report of the experiments in the smelting of Canadian mine ores by the electro-thermic process, at Sault Ste. Marie, will soon be available for distribution, as well as a monograph on graphite, and preliminary reports by Messrs. Hille, Cirkel and Dr. Woodman, on the iron ore deposits in Northwestern Ontario, along the Ottawa Valley and in the United States.

COBALT SHIPMENTS.

The official figures of the shipments of ore to the smelters from the mines in the Cobalt and Haileybury districts over the Temiskaming and Northern Ontario Railway for the month of October have been issued. The aggregate of the ore was 1,120 tons. The details and dates of the shipments follow, the amount of ore being in pounds:

From Cobalt—Oct. 2, La Rose mine, 43,000 pounds; Oct. 2, A. Longwell, 60,000; Oct. 2, American S. & R. Co., 40,000; Oct. 3, C. L. Dennison, 60,000; Oct. 3, Balbach Smelting Co., 60,000; Oct. 3, C. L. Dennison, 40,000; Oct. 5, Nipissing mine, 61,730; Oct. 5, Nipissing mine, 60,450; Oct. 5, Foster mine, 64,000; Oct. 5, F. L. Culver, 40,040; Oct. 6, R. A. Bailey, 60,000; Oct. 9, American Smelting Co., 60,000; Oct. 9, Nipissing mine, 60,275; Oct. 9, Nipissing mine, 60,020; Oct. 11, American S. & R. Co., 60,000; Oct. 13, Nipissing mine, 60,490; Oct. 13, Nipissing mine, 40,540; Oct. 15, Nipissing mine, 60,130; Oct. 16, University mine, 45,000; Oct. 16, Nipissing mine, 61,710; Oct. 16, Nipissing mine, 41,560; Oct. 16, La Rose mine, 53,600; Oct. 18, Nipissing mine, 49,820; Oct. 20, Nipissing mine, 60,090; Oct. 20, Nipissing mine, 60,080; Oct. 23, Nipissing mine, 61,230; Oct. 23, F. L. Culver, 41,560; Oct. 23, F. L. Culver, 56,780; Oct. 24, A. Longwell, 60,000; Oct. 24, A. Longwell, 60,000; Oct, 25, Nipissing mine, 61,490; Oct. 25, Nipissing mine, 59,500; Oct. 26, Foster mine, 63,000; Oct. 26, Nipissing mine, 60,860; Oct. 29, Nipissing mine, 60,650; Oct. 30, American S. & R. Co., 56,000; Oct. 31, Silver Queen, 47,590; Oct. 31, C. L. Dennison, 40,000; Oct. 31, Nipissing mine, 50,430.

From Haileybury—Oct. 24, W. G. Hunt, 40,000 pounds.

THE CONSOLIDATED MINING AND SMELTING CO. OF CANADA.

The first report of this company, covering the six months ending June the 30th, 1906, has just been issued, and is given elsewhere in this issue. It is, without peradventure, the most remarkable document of the kind ever made public by a Canadian mining concern. The sort of thing it develops is what we are accustomed to find in the reports of the Banks of Montreal, and of Toronto, the Canadian Pacific Railway, etc., but that a Canadian mining company should minimise its earning power and disguise its assets is a new experience.

The Consolidated Mines was formed about a year ago, to take over the Trail Smelter and the War Eagle, Centre Star mines, etc.

The first operation was the amalgamation of the War Eagle with the Centre Star. The par value of the War Eagle was reduced by this operation from $1,750,000 to $1,166,667. The St. Eugene, one of the big silver-lead properties of the world was also taken in, and the Consolidated figured out, as follows:—

Old value.	Companies.	New value.
$3,500,000	St. Eugene	$2,333,300
4,666,667 (estimated cost)	Centre Star	1,555,500
1,500,000	Trail Smelter	750,000
600,000	Rossland Power	60,000
$10,266,667		$4,698,800

When you leave 46c, and run off 55c on the dollar, of "stock water," you use the spigot somewhat freely, and, to say the least of the matter, it reverses the usual process of consolidation.

The new business began business as follows:—

Assets.

Mines and Plant	$3,900,000
Cash in Bank	325,315
Ore Shipments	153,628
Government Bounties due	17,450
Accounts receivable	100,274
Stores on hand.	202,220
	$4,698,887

As, however, it was announced in the initial report that the stock of metals, ores, etc., on hand when the Company took over its property to the value of $902,460, could be purchased on favorable terms, the business was in all probability actually inaugurated with gross assets of $5,286,087, and liabilities of $577,145 over and above the capital stock of $4,698,887. This was probably a bank loan in some form or shape. After six months of actual operation, the directors are able to report that the assets have increased to $5,532,327, an increase of $256,300.

The property account has been increased to $4,047,586, an increase of $147,586. This includes the Iron Mask, an abutting mining claim, purchased during the half year, and an expenditure of $130,997 on construction account.

The stock of smelter products, on hand, or shipped, ores, etc., has increased to $1,148,233, an increase of $86,147.

Fluid assets, stores, accounts receivable and bounties, etc., has increased to $333,299.55, an increase of $13,355.

The increase in these assets, amounts, therefore, to $247,088. The indebtedness to the Bank at the date of the statement applying to the portion of the business was $415,081.52, and there is an additional liability of $78,000, a guaranteed advance to the Snow-Shoe, to be repaid to the bank from the ore supplied by this mine.

In addition, one quarterly dividend of $117,470 was actually paid at that time. Two dividends of the same amount have since been paid.

The profit and loss account for the six months is, however, the most interesting statement of this kind possible. It is probably unique.

In all 157,640 tons of ore was smelted, yielding 64,590 oz. gold, 1,074,255 oz. silver, 15,133,683 lbs. lead, 2,391,161 lbs. copper, to a value of $2,994,927, and of this $1,622,450 came from the companies own mines.

The actual cost of mining, smelting and shipping this metal was $2,942,809.18. The sales of smelter products and of ores amounted to $3,309,-665.20, a difference of $356,856.02, on the right side, but in addition the stock of metals and ores on hand had increased from $908,144.20 to $1,248,233.50, an increase of $346,089, so that the surplus over cost of production is $702,945. This is the surplus profit for the six months operation of a Canadian mining company, that is in the mining business as a business. The profit shown is only $325,854, and this result is obtained by charging off $245,176.48 for development work in the mines, and writing off $45,905 for depreciation.

The gross profit is magnificent and if the $245,000 spent on development does not represent the daily and hourly development necessary to the success of any mining property, but is, as there is reason to believe, the sort of "development that does not require to be repeated," the future of the concern would seem very bright.

The expenditure on the property admitted during the six months is:

On Construction Account	$130,979
On Development Work	245,176
	$376,155

In his report, the managing director informs the directors that during the six months there has been 15,461 feet of workings driven in the company's mine.

That an 1,100 horse hoist has been installed in Centre Star, and the workings of Centre Star, War Eagle and Iron Mask have been united so that in future, all the ore will be hauled up one shaft in 4½ ton skips.

That the electrolytic lead refinery has been increased in capacity from 50 tons to 75 tons per day, a new copper furnace added and other refining improvements made.

That the Iron Mask, a mining property having $242,451 of "probable ore" has been acquired.

The ore reserves of both the St. Eugene and the Centre Star have been increased.

This really means a great deal to get for $376,155 practically written off the profits for the first six months of even a "consolidated" business.

That every dollar that has been spent on the working of the mines, their development, and on the smelter, has been well spent, is, we believe, an undoubted fact.

It must not be forgotten that the Consolidated Mining & Smelting Company is as much a manufacturing plant as is the United States Steel Company, for instance, and the continued success of this enterprise, means the continuous prosperity of the mining industry in the Rossland district. Incidentally, the shareholders of the Consolidated Mines and the Canadian Gold Fields Syndicate (a concern with $600,000 capital, holding $426,600 in shares par value of Consolidated Mining stock), are to be congratulated. The net earnings, as shown, amount to to $14.04 per cent. per annum, on the capital stock. The pertinent and remarkable fact is, that when in the natural course of events a profit of 30 per cent. could have been shown, the ultra conservative course of cutting down the declared profit to 14.04 has been adopted, and this by the biggest, the best managed and most enterprising mining concern in the country. Is this an indication that the day of wild cat "mining" stock mines has passed, and that of the man that mines ore for profit has come?

CANADIAN ZINC PRODUCTION.

The report of the Commission appointed to investigate the zinc resources of British Columbia, and the conditions affecting their exploitation, is being distributed by Dr. Eugene Haanel, Ph.D., Superintendent of Mines.

Our readers will recollect that this Commission was instructed to undertake the investigation of the zinc resources of British Columbia, and their commercial possibilities during the summer of 1905. The gentlemen who composed it were: Mr. Walter Renton Ingalls, editor of the Engineering and Mining Journal, New York City; Mr. Phillip R. Argall, M.E., of Denver, and Mr. A. C. Garde, of Nelson, the former taking charge of the field work in connection with the developed mines of the province, the latter acting as Mr. Argall's assistant.

The report is a volume of 400 pages, and deals exhaustively with the production of British Columbia, the character of the ore, the markets, valuation, and cost of smelting, and, moreover, gives a history of the industry since its inception.

The districts treated of in detail, comprise:—Ainsworth, Slocan, East Kootenay, Nelson, Vancouver Island, and Texada, the coast of the mainland and the interior, from which it will be seen that all regions that have proved productive of zinc in British Columbia receive attention.

Mr. Ingalls says in his introduction that, British Columbia, the most westerly province of the Confederation forming the Dominion of Canada, comprises principally that section of British North America lying to the westward of the summit of the Rocky Mountains. The northern boundary of the province is the 60th parallel of latitude; its southern

Payne Tramway, Sandon, B.C.

boundary is the United States of America, or practically the 49th parallel; on the west it is bounded by the Pacific Ocean, and on the east by the Rocky Mountains; beyond that by the 120th meridian of west longitude. The total area of British Columbia is about 382,000 square miles. The country is traversed in a north-westerly direction by four more or less continuous chains of mountains, between which lie long and generally narrow valleys. These valleys form the channels of streams, which drain into the Columbia River; and in the southern part of the province several of them are occupied by long, rather narrow, navigable lakes, affording means of water-transportation, which have been extensively employed. This system of lakes has had an important bearing upon the development of the mineral resources of the province.

It was not until 1893 that the lode mines of British Columbia really began to be productive, the output from this source during the six years immediately prior to that date, amounting to an average value of only $60,000 a year, was derived from selected rich ores found near the existing lines of transportation.

In 1893, however, the value of the production of the lode mines of the province rose to $300,000, since which time there has been a steady increase, until in 1901 the output from this class of mining reached a value of $13,683,044. It fell off slighly in 1902, but the decrease was due principally to the lower market value prevailing, and in 1903 an upward tendency again became apparent.

The total shipments of zinc ore from the Slocan district, according to a statement by Mr. A. C. Gardé, from the Canadian Pacific Railway office at Nelson, B.C., are shown in the subjoined table. which include the ore passing over both the Canadian Pacific and Kaslo & Slocan roads:

Name of Mine.	1902.	1903.	1904.	1905.
Bosun	580	681	...	...
Wakefield	35	181	151	...
Payne	667	610	1,001	98
Whitewater	...	...	...	101
Ivanhoe	...	256	902	713
Hartney	...	...	21	...
Wellington	...	...	...	33
Bound Main	...	...	60	...
Lucky Jim	...	...	48	2,462
Idaho-Alamo	...	...	30	60
Slocan Star	...	686	...	3,978
Canadian Smelt'g Wks.	...	...	...	260
American Boy	...	...	21	129
Last Chance	...	...	...	22
Blue Bell	...	...	...	37
Total	1,282	2,564	2,084	7,893

The statistics for 1905 cover only the first ten months of the year.

According to information furnished by Mr. Mackintosh, collector of the port, the shipments of ore passing through Kaslo, destined to the United States, from January 1 to October 31, 1905, were as follows:—

Name of Mine.	Tons.	Grade of Ore.						Remarks.
Lucky Jim	2785	53%	Zn.	9.5%	Pb.	3 oz.	Ag.	Lump ore.
Whitewater.	101	47	"	3.0	"	33	"	" "
Wellington.	32	50	"	3.0	"	55	"	" "
Last Chance.	64	35	"	4.0	"	66	"	" "
Amer'n. Boy	140	42	"	7.0	"	9	"	" "
		47	"	2.0	"	15	"	" "
Slocan Star..	3566	32	"	3.0	"	32	"	Concentrate.
		35	"	2.5	"	45	"	"
Silver Bell	37	49	"	0.5	"	4	"	Lump ore.
Total	4125							

Mr. G. O. Buchanan, Dominion Inspector of Lead Bounties, Kaslo, B.C., communicated to me, under date Dec. 15, 1905, the following statistics of zinc ore production in 1905, compiled from reports received from the owners and managers of the respective mines:—

Name of Mine.	Tons.	Assay in Zinc.	Remarks.
Slocan Star	4,093	33.5%	Concentrate
Lucky Jim	4,600	54.0	Lump Ore t
Lucky Jim	7.45	48.0	Concentrate
Ivanhoe	541	46.0	"
Ruth	1,000	38.0	"
Jackson	1,150	38.0	"
Bell	130	50.0	"
Idaho	61	37.4	"
All others (estimated.	1,000	40.0	"
Total	13,320	42.0	

It may be safely estimated that the shipments of zinc ore from British Columbia since the beginning have been approximately as follows:—

Year.	Tons.	Year.	Tons.
1899	1,600	1903	2,564
1900	none	1904	2,828
1901	none	1905	8,561
1902	1,282		

The actual production in 1905 was possibly 3,000 to 4,000 tons more than the shipments, but this is largely ore held for treatment by magnetic separation for the enrichment of its grade in zinc, which will correspondingly reduce its weight.

The zinc ore so far produced in British Columbia has been blende. No calamine has been shipped, and the existence of any important supply of that class of ore has not been reported. The blende has been shipped partly as hand-sorted lump ore; partly as mill-concentrate. The former has been of the highest grade in zinc. The grade of the mill-concentrate is reduced by the intermixture of siderite (spathic iron ore) and pyrites (pyrite and pyrrhotite), which occur commonly with the blende of the Slocan, and cannot be satisfactorily separated by ordinary mechanical concentration.

The blende of the Slocan is commonly of the variety known as "black jack," and is generally of bright luster. The black coloration of blende is not necessarily an indication of high content in combined iron; for example, the blende, of Wisconsin, is sometimes black, but is low in combined iron. Blendes which are black in color and of brilliant lustre are apt to be high in combined iron, but not always. The Slocan blendes do not appear to be high in combined iron as a general thing; nor are they, as a rule, high in cadmium.

The analysis of Slocan zinc ores show that they contain few objectionable impurities, and none of them in excessively large quantity. The percentage of iron is moderate and the percentage of lead is low. As a general thing, the ores are rather low in cadmium; some of them contain a little manganese, but not much. The percentage of lime is very small. Fluorspar is entirely absent. Arsenic and antimony are present in some of the ores. The coarser portions of the solid zinc ores can be hand-sorted up to a tenor of 50 per cent. zinc. By combined wet and magnetic concentration ore assaying as high as 55 per cent. zinc can be produced, and 50 per cent. zinc ought to be a fair standard of practice with regard to a large class of ores.

The zinc ore which has been heretofore produced in British Columbia has been marketed chiefly in the United States, the smelters at Pueblo, Colo., and at several points in Kansas having been the principal buyers.

A comparatively small quantity of ore has been exported to Europe. Since about the end of November, 1905, a smelter at Frank, Alberta, has been in the market for these ores. There are, therefore, three markets open to the ores of British Columbia, viz.:—(1) the American; (2) the European; (3) the Canadian, which, however, is still in a tentative condition. With respect to these markets widely different conditions obtain.

The value of a zinc ore depends chiefly upon its tenor in zinc and objectionable impurities; especially iron, manganese and lime, which increase the corrosion of the retorts; and lead, arsenic, and antimony, which contaminate the spelter. The value of the ore is also affected by its character, whether oxidized or sulphide, or a mixture of both; the sulphide ore must be roasted, but yields a diminished weight for the subsequent treatment, which is the more expensive part of the process; the oxidized ore escapes preliminary treatment, unless it be carbonate, but suffers no diminution in weight. The preliminary treatment of ores which are mixtures of sulphides and oxides, is often troublesome. The value of an ore is, moreover, affected by its physical character. Lump ore is subjected to an additional expense for crushing; fine slimes are more expensive and troublesome to roast than coarser concentrates. Some ores roast and distil easily; others with more difficulty. All these factors are given consideration by the zinc smelter. The chemical composition of the ore is, however, the most important factor in determining its value.

In determining the treatment charge on the ore purchased, the smelter starts with the cost of smelting a ton of the ore of average composition, that is to say, the mixture on which he proposes to operate his furnaces on the same charge, for various reasons, to this smelting charge he adds the profit that he ought to make to obtain a proper interest on his investment allowing for the necessary amortization of his outlay in plant.

The further addition of the freight on the ore to his works, and on the spelter product to its market, with allowances for the cost of buying the ore and selling the spelter, gives the returning charge which he must make against the ore in buying on the basis of f.o.b. cars at the mine or mill where produced.

The ores purchased will be of various kinds. Few will correspond exactly with the ore which is aimed to charge into the furnaces. Some will be higher in zinc; others will be lower. Some will be too high in iron; others too high in lime. The very desirable ores can perhaps be purchased only at a small margin. The deficiency must then be made up from the price of the less desirable ore. Inasmuch as the various kinds of ore may not be bought contemporaneously, the smelter effects this balancing in price by arbitrary additions to the returning charge on certain kinds of ore, according to the percentage of objectionable impurities contained. It may be necessary under certain contingencies to put a less advantageous charge into his furnaces, when the cost of smelting will be directly increased, and the percentage of metal extraction decreased, by greater destruction of retorts, higher zinc tenor of the residues, or some other factors which have a powerful influence on the ledger.

It is the custom of European smelters to pay for ores according to a sliding scale, which combines three elements, viz.: The price of spelter and zinc content of the ore, which are variables, and the returning charge per ton of ore which is fixed. This sliding scale is embodied in a convenient formula, from which any seller of ore can readily compute the value, the returning charge having previously been agreed upon in the contract.

American smelters compute the value of ore in practically the same way, but in purchasing custom lots of ore they make, usually, a direct bid of so much per ton, and in purchasing ore on contract they frequently employ an involved sliding scale, which is generally equitable, though less simple than the European.

The cost of smelting ores is but imperfectly understood by those who have not had experience in the business. This does not refer only to the smelting of zinc ores, but also to the smelting of other kinds of ore. I may go further and say that it is imperfectly understood even by many metallurgists who are practically engaged in the business. The operating cost per ton of ore smelted is one thing; this is comparatively easy to determine, but it tells only part of the story. The total cost of smelting is quite another thing, and is not so easy to determine; this includes not only the direct operating cost, but also the allowances for administration of the business, interest on the money invested, and amortization of the capital laid down in plant construction. The capitalists who invest their money in a metallurgical plant not only expect to receive a proper interest on it, but also expect to preserve the principal intact. The subject has been discussed so thoroughly in industrial economics that it is unnecessary to go into it here to any further extent than will outline the fundamental principles.

There have been instances where plants have been erected for the specific purpose of working up a definite supply of material, only that and nothing more. Assuming it to be contemplated that such a purpose will be consummated in two years of time, it is obviously necessary to charge one year's operation with one half of the cost of the plant. Ordinarily, however, the calculation for amortization is not so simple, because the life of the plant can not be so definitely foretold, but even under the most favorable prospects as to continuance of the supplies of raw material, and the conditions which govern the operation of the works and the marketing of its products there are considerations as to the life of the plant, both in part and as a whole. Some of its apparatus, in spite of the most liberal outlay for repairs and renewals, will wear and become useless, often in a comparatively few years. Other parts may, perhaps, be kept in excellent condition for many years, but may become unprofitable through advances in the art, whereby the competition of more modern and superior methods of machines may render the old ones practically useless. This consideration, which has aptly been referred to as "depreciation due to the advance in the state of art," applies not only to particular machines and methods, but also to the plant as a whole. Anyone who will look around in the industry with which he is most familiar, and will observe the number of plants of no more than ten years' construction, which have become idle and out of date, will appreciate the importance of this industrial calculation.

It is a common practice among engineers in considering the probable standing of a new metallurgical project to reckon an amortization period of ten years, i.e., the first cost of the plant must be reimbursed in that time, not necessarily with a view to the distribution of the original investment among the subscribers, but rather with view to the maintenance of the value of the plant to the possible extent of a complete replacement at the end of the time reckoned. Prudence seldom permits the estimate of a longer amortization period than ten years. In some cases it is unsafe even to reckon so long a time as that. The assumption of an amortization period of ten years implies that 10 per cent. of the first cost of the plant must be added annually to all the cost of direct operation, and, moreover, a certain interest charge must be added in order to arrive at the actual cost of the production. Reduced to the basis of a ton of ore the relative magnitude of these charges depends upon the cost of plant per ton of annual capacity. For example, the cost of a first-class copper smelting plant of 1,000 tons daily capacity, or, say, 350,000 tons per annum, is about $600,000, which is about $1.70 per ton of annual capacity. The cost of a silver-lead smelting plant of the same capacity is about $800,000, which is about $2.50 per ton of annual capacity. The cost of smelting a ton of copper ore in such a plant is roughly about $2.50; the cost of smelting a ton of silver-lead ore is, roughly, about $3.50. In the former case about 15c per ton should be added to the smelting cost for amortization; in the latter case 23 cents per ton; in both cases the amortization charges are only about 7 per cent. of the direct operating cost. In zinc smelting the conditions are quite different, not only in this, but also in other respects.

The metallurgy of zinc is frequently spoken of as a backward art, the smelting process still being expensive as compared with that of lead and copper ores, while the proportionate extraction of metal is greatly inferior. This idea rests, however, on false standards of comparison. The zinc smelter, as a rule, deals with ore which has already been enriched to a high degree, so that this practice is comparable to that of the smelter of galena concentrate, or of black tin ore, rather than to that of the silver-lead or copper smelter, who has to treat a very large quantity of ore for a comparatively small production of metal. In other words, while the copper smelter makes commonly a concentration of 20 to 1 and even 50 to 1, the zinc smelter makes a concentration of only 2 to 1 or 3 to 1. In handling the less quantity of raw material, it is generally permissible to utilize wheelbarrow and shovel to a greater extent; but if the cost of the process be referred to the basis of the crude ore raised from the mine, the smelting expense may not appear unduly heavy.

The addition which is lent to the value of zinc ore by a silver content is a matter of both interest and importance in connection with the ores of British Columbia, inasmuch as they are generally silver-bearing; occasionally silver-bearing to a high degree. The highly argentiferous ore, however, is much smaller in proportion than the ore which is comparatively low in silver. In some cases the ores run very high in silver, but such occurrences exist elsewhere, especially where tetrahedrite (grey copper ore) or similar silver minerals are associated with the blends. These high silver-zinc ores, however, are commonly considered not as material for the zinc smelters, but for the silver-lead smelters, to whom they are disposed of.

There are comparatively few American smelters who are equipped, or are in a position to extract silver and lead from the zinc ore which they treat. There will doubtless be, however, an extension of interest in this direction. In such cases as the smelters are especially in the market for this class of ore, the practice of purchasing is similar to the European. Thus, one contract for Canadian ore provided for the payment of silver in excess of 8 oz. a ton at the rate of 50 per cent. of the New York quotation for silver. On an ore assaying 20 oz. silver per ton, 40 per cent. zinc, and over 5 per cent. lead, a price of $9.50 per ton f.o.b., Sandon, was made in August, 1905; with a zinc variation of 75c per unit above or below 40; and a silver variation of 40c per oz. above or below 20 oz.

A vast amount of ingenuity, energy, and money has been spent, since 1860, upon the development of hydrometallurgical processes of zinc extraction, the idea being to bring the zinc into solution (usually as sulphate); separate the solution from the residue (which will contain the silver and lead of the ore, together with the gangue); precipitate the zinc by suitable re-agents, and pass the product on to the smelting furnaces, or precipitate it in metallic form by electrolysis; and pass the insoluble residue on to the lead furnaces.

Electrometallurgical processes of this character are hopeless, save under certain especially favorable conditions, primarily because of the high amount of power that is inevitably required to electrolyze solutions of any of the salts of zinc. Vast sums of money have been expended in proving by the erection of large works for the operation of such processes the fundamental principles, which could have been worked out in the office, and the practical behavior of the scheme working, which could have been determined in the testing-laboratory, for one per cent. of the money. The conditions under which processes of this character may prove workable are: (1) in the case of processes affording a useful anode reaction, the application at places where advantage can profitably be taken of it; and (2) the availability of very cheap water power.

It is extremely doubtful if any hydro-metallurgical or electro-metallurgical process, even under the most favorable conditions, could show a commercial superiority over the present combination of standard methods in the treatment of such an ore as has been referred to. Starting with an ore containing 24 per cent. zinc and 6 per cent. lead, separated magnetically or electro-statically at a cost of $1.00 per ton, approximately 0.33 ton of zinc ore, containing 50 per cent. zinc, or nearly 69 per cent. of the zinc in the original ore, and 0.55 ton of lead-iron ore containing 9 per cent. lead, or approximately 82.5 per cent. of the lead in the original ore, are obtained. Carrying the computation forward to the final extraction of the metals, good practice should yield about 60 per cent. of the original zinc and 78 per cent. of the original lead, at an aggregate cost not to exceed $7.00 per ton of crude ore, disregarding freights, interest, amortization of the plant, etc. A complete analysis of this plant would be quite complicated, but the above figures will give a rough indication of the present state of the art.

THE LA PLATA.

By Alfred W. Dyer.

The story of the progress of the Molly Gibson (La Plata) mine is a story of great progress under tremendous difficulties. In the first place the mine is situated at the foot of a glacier, 20 miles from Nelson, and ten miles from the nearest shore of the west arm of Kootenay Lake, 7,500 feet above sea level, and, therefore, nearly 6,000 feet above the level of the lake. Further, the ore is contained in a vein which, though strong and continuous for several thousand feet, is yet of varying width. Its value, after being gophered for years, is about $13 per ton, the returns being chiefly in silver. As transportation by waggon to the lake is about $4.00 a ton, and the further freight and treatment, $12, it will be seen that the company was facing a difficult problem, when the further development of the property was decided upon two years ago.

Then Captain Trethewey was placed in charge. He found that the old tramway, connecting the mine with the end of the waggon road, 2,500 feet below, was down, that the mine buildings were destroyed; that a mill would be needed to treat the ore, and that a lake had to be dammed and a flume constructed to get the necessary power. Moreover, it was necessary to first place a sawmill on the ground.

All these things have been done. The mill made its first run in June and completed a month's work with an average saving of over 80 per cent. after the failures of the inception are neglected. Now the company is installing a compressor.

The vein runs east and west for 10,000 feet. It has been opened by a series of tunnels, eight adits in all, showing the ore body to be continuous from the extremities of the workings for 2,500 feet. This also gives a depth of 750 feet. The management thinks it has sufficient ore in sight to keep the new mill going for the next ten years, without any further development.

The ore runs from 15 ounces up to 100 or more with about 2 to 4 per cent. of lead, with a zinc content that seldoms exceeds, in the concentrates, the ten per cent. limit now imposed by the Kootenay smelters. The country rock is a felspathic granite with unusually large felspar crystals. There is some intrusive diorite but the vein is little disturbed.

The mill is fed by an aerial tramway 8,450 feet in length. It is of the button and clutch type, built by Fraser & Chalmers. The ore is dumped on a grizzley, the oversize passing into a Blake rockbreaker, and thence on to an 80-foot travelling belt, where a certain portion, something less than a fourth, is taken out, as clean ore and fit for direct shipment. The remainder falls through a chute into a Star crusher, and is automatically hoisted to the top of the mill. At the crusher a sample of the heads is taken. The sampler passes through the ore flow twice, and hence takes double the portion from the surface, the lighter and less valuable part of the flow, than from the bottom. Hence the head samples show less than the value of the ore. At the top of the building the ore flow is directed through trommels. All oversize, not being able to pass the ½-inch mesh, is sent back to the crusher, automatically. From the trommel the flow passes to the first and second jigs, of two and three compartments respectively. The remainder in the first jig is conducted directly to the ore bins, the second compartment containing the middlings. In the second jig the first compartment saves the clean ore, and the second and third the middlings. The overflow from both jigs is waste and goes directly out of the mill. One-fourth of the feed is thus thrown out of the mill at an early stage in the working. About five-eighths is treated as middlings and one-eighth is directly saved. The tailings seldom run over an ounce, and it is to this system that Captain Trethewey places the high recovery of the mill.

The middlings go through a second crusher, through a second trommel, exactly as before and thence through four hydraulic classifiers. The coarser particles are sent through launders to three five-compartmented jigs, the waste eliminated and the remainder sent back to a five-stamp battery, but it is only a very small percentage of the original mill feed which is thus expensively treated.

From the battery the flow is again directed to hydraulic classifiers, jigs, settling tanks, Overstrom tables and Frue vanners. The remainder passes away as tailings. In these tailings the chief loss is made. The more perceptible, the higher the zinc content. The management have under consideration various methods of impounding these tailings for future recovery.

The concentrate thus made runs six or seven to one. For the last week in June the mill feed ran 17½ ounces silver; three per cent. lead; one per cent. zinc. The concentrates represented 107 ounces silver, 29 per cent. lead and 12 per cent. zinc.

The mill is run by water power obtained by damming a glacier fed lake, 300 feet above and about three and one-quarter mile distant. A Pelton wheel, of 15 h.p. runs belt and breaker, and another wheel of 50 h.p. runs the mill. Two men run the whole of the mill proper, with another man on the ore belt; another sacking ore, and a third running the tramway. The capacity, one shift a day of 12 hours, is between 50 and 60 tons, which is the output of the mine for the present and until the compressor can be installed for steam drilling.

MINING LAWS.

By Dr. W. S. Goodwin.

Ore deposits differ from every other large asset of a country in a very important respect. They are not in any way reproducible. Agricultural products are continuous year after year so long as the soil remains fertile naturally or is kept up to its fertility artificially. Fish reproduce as fast as they are caught, so long as the catching is done in a regulated conservative way. With a proper system, the forest yields its crop from generation to generation without any tendency to exhaustion. But, once an ore deposit is removed (with one or two exceptions), it is not replaced within any period which comes under human observation. This peculiarity gives valuable minerals the character of hidden treasures, to be found and used. It is on this account, no doubt, that in most countries, mineral rights are reserved to the Crown when surface rights are granted, sold, or leased by a government; and the laws under which mineral rights are disposed of by a government form a problem with which all mineral countries have wrestled. Mineral resources, to be available, must first be found, and they must next be developed and mined. Here is where the difficulty arises in framing a mining law. On the one hand the law must give encouragement and fair play to the men who search for and find the valuable deposits. On the other, it must so guard and define the general public interests that development and mining shall not be retarded or indefinitely postponed. It should be noted that development and mining may be interfered with in two very different ways: (1) by a law which makes such burdensome conditions that the tempting profits of mining operations disappear, and (2) by a "wide open" law, which allows large areas of mineral lands to be held undeveloped for speculative purposes.

Perhaps the most difficult problem of all in mining legislation is that of the conditions upon which a mining claim is allowed. There are two extremes: (1) the enaction of a *bona fide* discovery, and (2) granting the mineral rights merely upon application. The former implies inspection by a properly qualified government officer. That this is the case is shown by the universal experience in countries where discovery is required by law, but where the affirmation of the applicant is taken as sufficient. In all such cases that part of the law has become a dead letter and many applicants lightly perjure themselves as a matter of use and wont. This has been well illustrated by a number of cases to which attention has been lately called in Ontario. Experience and common sense agree in the verdict, that if discovery is required it must be accompanied by

Ivanhoe Mill.

inspection. To require discovery without inspection is to make a law and leave it to work itself. That such laws always become a dead letter is a well-recognized fact in legislation. Factory acts imply inspectors. So do liquor license laws, stumpage, etc., ad infinitum. Inspection is thus a necessity; but it is also regarded by many as a boon to the *bona fide* prospector. He gets for a nominal sum the report of an expert on his discovery. This puts upon governments the necessity of appointing none but the best men to such positions.

Undoubtedly hard cases arise when discovery is required as a condition for granting a claim. It is a nice question sometimes to decide whether or not a discovery of valuable mineral has been made. The inspector must be a man of cool judgment and discrimination. But so must be every judge and administrator of the law. It would be difficult to find any law which does not, here and there, in the course of its administration bear hardly upon individuals. The law is often blamed for what is really the bad luck of the prospector,—which is after all quite according to human nature.

But does it improve matters to grant claims without any proof of discovery? On the whole, experience answers in the negative. The "blanketting" of large tracts is a practice objected to both by prospectors and by investors.

If a prospector has made a discovery of any value he can always find sale for it. If he claims a lot upon which he has not made a discovery, it seems unreasonable to give him the exclusive right to the minerals which may possibly be found on that lot. It can hardly be argued that he has earned the right. That he has gone over a great deal of rough country, endured hardships and spent time and money in the search, is hardly an argument, unless it is granted that a man should be rewarded in this way for hunting for minerals.

Is there any middle ground between discovery and inspection and no discovery, as requirements? It is often claimed that rigid working conditions may be well substituted for discovery; but an analysis of the case where a first discovery has been made in a new district shows that working conditions with no discovery favor the man with money and practically exclude the poor man. The more rigid they are, the worse it is for the man with no capital. Now it is certainly due to the prospector that any law regulating the staking of mining claims should give an equal chance to all.

The mining law at present in force in Ontario has been lately subjected to criticism. There have been public meetings and resolutions passed asking for modifications; but there seems to have been a good deal of difference of opinion as to the modifications, particularly at a meeting held in Cobalt, where a resolution was passed opposed to those carried in other places. As Cobalt is a very important prospecting and mining centre just now, the conclusions reached by a meeting called by public notice in that place should be carefully weighed. These conclusions seem to have favored the law as it now stands with such small modifications as experience of its workings should point out. The chief objections urged against the law are (1) the provision for inspection, (2) the long time (60 days) between the giving of notice and the granting of a working permit, and (3) the registration of numerous applications for the same claim pending inspection of the claim. The latter is rather a criticism of the administration of the law than of the law itself, which implies, although it does not clearly state, that only one application for a claim shall be received by the recorder and that this application must be disposed of adversely before another can be received. The practice in the Cobalt district was to receive all applications; but the recorder has now been directed to receive hereafter only the first application and to refuse all others, unless the claim is thrown open after inspection.

It is claimed by advocates of free staking without discovery that the man who stakes out a claim should be considered to have acquired by that act and by the performance of certain other conditions exclusive rights. This seems to be open to objection. It may be asked whether such a claim would differ from a claim to any other public property based upon a similar performance of certain acts. It may be accepted as a general principle that a man should do something considerable to earn a share of such property. Being the first to arrive on the spot and planting four stakes hardly fills the bill. The law gives a special reward to the man who makes the first discovery in a new district, because his work has extended the known mineral area of the country, but surely the next comer and all those who follow should be required to show that they, too, have added to the known mineral deposits before they are allowed to have exclusive possession of a mineral claim.

It is held by some that so long as a man is willing to go on working a claim he should have exclusive possession. It may be asked, what are you to do with the other men who are willing to work and spend money on that claim? What has the first comer really done to give him the exclusive right to search there? There may be a difference of only a day or an hour in the arrival of two claimants. Can it be justly argued that the first comer, simply because he is first, has acquired an exclusive right? It must not be lost sight of that the laws for the distribution of property vested in the Crown should be so framed as to advance the general as well as the particular interests. This is the spirit of the law for distributing agricultural lands. A man who takes up a lot is required to live on it and clear it to a certain extent. In return for his possession of the land he increases its value and begins to add to the production of the country. The case is different with mineral lands. Until a real discovery has been made, the only work which is of any use is exploration. It would be difficult to frame a law of working conditions based on this idea. But the principle is at least recognized in the mining law now in force in Ontario. See sections on Working Permit (142), and Prospecting Permits (183), where an attempt is made to reconcile the rights of the single prospector exploring at large with those of the investor who is prepared to make a more complete, expensive, and thorough exploration of a limited area, provided that he can secure undisturbed possession while doing so. As the law is, the working permit is not granted until sixty days after notice is given. Thus, anyone is free to prospect for sixty days. After that the holder of the working permit has exclusive rights.

To our mind, the whole difficulty lies in making a law which shall duly regulate and restrain, not the real prospector, who makes a discovery, but the crowd who follow him and get all around to share in his discovery without themselves adding anything to it.

The ideal mining law would secure the widest possible distribution of original private ownership. That is, it would distribute to the many, rather than concentrate on the few. If economic development required concentration, this would naturally take place by purchase afterwards. A "wide open" law seems to allow this concentration at the beginning. It might be argued that a large investor could hire a number of prospectors and so secure large areas at the start. This answers the same purpose, if discovery is required. Experience shows that investors get the best results in such cases by giving prospectors a share in their finds, and thus distribution is secured.

In all this discussion it must not be forgotten that a very grave difficulty presents itself in defining what shall constitute a discovery. Inspection might perhaps be dispensed with and the definition left with the prospector, were it not for the blanketter who follows on his heels. But the duties of an inspector are so difficult, delicate, and, at the same time, authoritative, that it is imperative that only men of the highest possible qualifications should be appointed.

It is claimed by some that capital is scared away by the inspection requirement. Capital is hardly so timid when the capitalist has a *bona fide* mining property before him; and it never does a country any permanent good, but the contrary to attract a lot of capital to schemes which turn out failures. A few may benefit by the sale of claims which never yield any returns, but it is at the expense of the many whose property is depreciated by such failures. A mining law which attracts the capital referred to in the proverb "A fool and his money are soon parted," is not the best law for a mining country.

RECENT PROGRESS IN METALLURGY.

By Prof. A. E. Outerbridge.

During the year past the production of all metals has been phenomenally large. The rise and fall in the production of pig iron has long been regarded as a sort of barometer of business prosperity for allied lines of industry, and all previous records fade into insignificance when compared with those of the year ending June 30th last, for in that period of time the production of pig iron in the United States amounted to no less than 24,432,106 tons. The production in the State of Pennsylvania alone was, in 1905, 10,579,127 tons, or about two million tons more than the total production in the United States in 1896. Those who are interested in such matters will, no doubt, remember the astonishment that was caused when the statistics of production of pig iron in 1898 were published, showing a total of 11,773,394 tons, or nearly one million tons a month. Since that time we have advanced by leaps and bounds until now we are actually producing over two million tons a month of pig iron.

An interesting improvement in the pig iron industry, to wit: the Gayley Dry-Air Blast Process is worth noticing. The process has proved itself to be highly economical and will doubtless be largely introduced. During the year 1905 there was produced 276,000 tons of pig iron by this method, and several large plants are now in course of construction.

The per capita consumption of pig iron in this country has risen to 620 pounds, as compared with 68 pounds as the average consumption of the total production in the world in 1905.

The remarkable activity here noted is not confined to iron, but extends to all metals, gold, copper, aluminum, etc. In 1880 the production of copper in the United States amounted to about 25,000 tons, or about one-sixth of the world's output. In 1905 the production was 397,909 tons, or about one-half of the world's output.

There is an unlimited demand for copper, just as there is for gold (due, however, to a different reason), and this has caused the price of copper to rise greatly, notwithstanding the fact that the cost of refining has been much reduced through the modern electrolytic methods. It is estimated that the aggregate profits of the producing industry in twenty-five years have amounted to the enormous sum of $675,000,000 on a total production of 9,000,000 tons. By far the largest proportion of these profits have been made within ten years.

The metal aluminum, once called "the metal of the future," is now entitled to a high place in the list of economic metals of to-day, the production having increased from a few pounds ten years ago to about 5,000 tons in 1905. Owing to the discovery of the electrolytic method of refining the cost of the pure metal has declined from $8 to less than 50 cents a pound.

Statistics were given to show that the remarkable increase in production of metals in 1905, as compared with previous years, was not confined to the United States, but was world wide. Canada, for example, showed an increase of no less than 171 per cent. in output of all kinds of steel ingots and castings in 1905 as compared with 1904, and an increase of more than 72 per cent. in crude pig iron.

The production of pig iron in Great Britain in 1905 was the largest in the history of the United Kingdom, being 9,592,737 tons, as compared with 8,562,658 tons in 1904.

The increase in output of Bessemer steel ingots in the same period was shown to be about in the same proportion and of open-hearth steel ingots in larger proportion.

In Germany production is recorded in metric tons, and there was a considerable increase in output of pig iron, steel ingots and castings in 1905 as compared with the previous year.

In France the increase in output was comparatively small, and the same is probably true with respect to Russia, Spain and Italy, though accurate statistics for these countries are not yet available.

Reference was made to the great progress made in recent years in recovering so-called waste products in various metallurgical operations, one of the most promising of these is the prospective utilization of vast accumulations of blast furnace slag in the manufacture of high-grade cement. The possibility of this has been talked of for years, for the reason that slag contains a great deal of lime, a material used in making cement, but, unfortunately, the sulphur in the slag is a deleterious element. Recently the United Steel Corporation has perfected a process, it is said, for eliminating sulphur and making fine cement from slag.

When we realize that the demand for cement is increasing every year, and has now reached enormous proportions (the output of cement in 1905 in this country exceed forty million barrels), we can appreciate the importance of this new undertaking It is stated that a subsidiary company has been very recently formed under the title of the Universal Portland Cement Company to manufacture cement from blast furnace slag.

The use of ferro-alloys in the manufacture of "high speed" steel for cutting tools has made great progress during the past year and has been extended in various directions with remarkable results. Large and costly milling cutters are now being made of this steel, as well as planer and lathe tools and drills. Improved methods of hardening and tempering this kind of steel have also been devised.

The use of ferro-alloys in the foundry is likewise extending. The simple method first described in the speaker's address given before the metallurgical section of the Institute a year ago for softening iron for castings to any desired degree has been continued, with exceedingly beneficial results, in his daily practice.

The speed of turning pulleys has been largely increased and the time required to complete the machine work upon them has been reduced, and in other light castings as well. In addition to the material improvement in the strength of the metal by this treatment, there is a decided decrease in shrinkage, so that some castings of irregular shape which are difficult to make without cracking in cooling owing to unequal strains are now made without this tendency by this process. Other advantages accruing from the addition of a very small amount of high-grade ferro-silicon (containing about 50 per cent. of silicon) have been observed. Among these may be mentioned the cleaning action upon the molten metal which the alloy effects by its deoxidizing influence. Singularly also it is found that commercially pure silicon does not produce these results, neither does the ordinary grade of ferro-silicon, containing about 20 per cent. of silicon.

In the case of pure silicon the specific gravity of the material is too low and its melting point too high to permit it to become incorporated with the molten iron in the ladle; in the other case the proportion of silicon is too low to permit a sufficient amount to be dissolved in the iron to produce a radical change in its quality without causing dull iron in the ladle.

There is, said the speaker, no doubt that when the merits, simplicity, certainty of action and other of this process of treating molten iron in the ladle are better known and appreciated it will come into very extensive use, for it enables the founder to modify the character of his iron to suit individual castings, a matter of considerable importance and value. This is accomplished without expense, for the cost of adding silicon to the iron in this manner is actually less than by the usual method of adding an equal amount of silicon to iron in the form of pig iron comparatively high in silicon added in the cupola. For example, pig iron containing 6 per cent. of silicon costs at the present time, let us say, $20 per ton, and we may estimate for comparative purposes $3.33 per unit of silicon; ferro-silicon containing 50 per cent. silicon costs at the present time in powdered form $100 per ton, or $2 per unit of silicon on the same basis of calculation.

Furthermore, there is no loss of silicon when added in the ladle as there is when melted in the cupola, and this partly accounts for the fact that a given quantity of silicon, when added in the ladle, is much more effective as a softener than the same quantity charged into the cupola. Silicon added in the cupola always weakens the iron, while silicon added in the ladle always strengthens it.

The output of gold has quadrupled in the past twenty years, and stands, as regards its rate of development, above all other metallurgical industries, iron alone excepted. In a recent résumé of two papers by M. de Launay, an eminent French mining engineer, and professor at the Ecole Supérieure des Mines, published in the Revue Générale des Sciences, the *Engineering Magazine* says: "The enormous increase in the rate of production of gold is one of the remarkable industrial and economic phenomena of the present time. The curves representing the production of other metals have shown upward tendency, more or less marked, but the line showing the gold production of the world shows such a remarkable upward tendency that at times it almost approaches the vertical. When the curve is separated into its three components, representing respectively the three principal sources, the Transvaal, the United States and Australia, it is seen that there is a marked similarity between them, interrupted only by the break due to the war in Africa. The figures for the year 1905 given by M. de Launay, in francs, are: Transvaal, 524 millions; Australia, 432 millions; the United States, 436 millions; a total of 1,392 million francs, or about 278 million dollars. These three countries produce 72 per cent. of the world's total, which reaches 1,908 millions of francs.* * * It is largely because of the improved process of extraction that the production of gold has increased at the rates already given, since it is by the wholesale application of modern methods that the lowest grade deposits can be commercially worked. Thus, in a large and accessible mine it is assumed, on an average, that the material can be treated for about 12 francs per ton. Very often, however, the cost reaches double this figure, according to location and operative difficulties. In the great workings in Dakota, on the contrary, the cost has fallen as low as 2.10 francs per ton, and at the Alaska Treadwell mine to the minimum of 1.12 francs.

It is interesting to recall the fact that many years ago the assayers of the mints found that gold was uniformly distributed in very minute division in the bed of clay underlying the city of Philadelphia, and they made the astounding statement in a paper published in the Proceedings of the American Philosophical Society that there was more gold underlying the streets of the city than had been taken at that time from California and Australia combined. There was enough gold (according to their calculations) in each brick, if hammered into leaf, to make a sheet of gold two inches square and about one-three hundred thousand of an inch thick. It was, of course, stated that the cost of extracting the gold would be far in excess of its value, but modern methods of refining low-grade ores had not been discovered at that time, and it may come to pass that the aluvial gold in the clay may yet have a market value. This, however, is a mere speculation at present. Certain it is that the vast increase in production of gold in modern times is due to the economical methods of reclaiming the gold from lean ores that had no value whatever at the time this interesting paper was published.

The increase in production of copper in the United States in recent years can be truly described as astounding, the output having risen from 25,000 tons in 1880 to 413,070 tons in 1905.

In the former year we produced about one-sixth of the world's output and in 1905 more than one-half. The enormous increase in production has been stimulated largely by the increased demand since the development of electric lighting and electric power. The price of copper has risen coincidentally with increase in production, notwithstanding the fact that modern methods have greatly reduced the cost of refining copper.

In 1880 the electrolytic method of refining was in its infancy; there was, in fact, no refining by this method recorded in this country in that year, while in 1905 the output of electrolytically refined copper in the United States was 304,000 tons, as compared with 46,000 tons in Europe.

The electrolytic process of refining copper is one of extreme simplicity; it depends primarily upon the passage of an electric current between two plates of copper suspended in a tank containing copper sulphate in solution. As only the copper in the crude metal can act as a carrier of the current the impurities are left behind, and pure copper alone is deposited on the plate of metal by which the current leaves the vat.

The impurities frequently consist of gold and silver in sufficient quantity to more than pay all cost of refining the copper by this process.

Referring to the new theories of matter which are now agitating the scientific world, the speaker said that the classic investigation of Sir William Crookes on "Radiant Matter," published more than a quarter of a century ago, paved the way for an entirely new conception of matter, for they seemed to prove that particles of matter existed and were even revealed in his high vacuum tubes very much smaller than the so-called "atom" which was at that time thought to be indivisible.

It is now believed that such particles, called electrons, are so minute that it would require one thousand of them to make one atom of hydrogen gas.

Not only is the heretofore accepted indivisibility of the atom disputed, but the stability of the atom has been attacked, and it is even maintained that the remarkable element radium has been actually seen to change, while under observation in the spectroscope, into another rare element called helium.

In studying these abstruse theories we are brought face to face with the fact of our ignorance regarding the true nature of matter and to a realization of how little we know of the forces of nature.

If the kinetic energy contained in a mass of radium is, as we are told, sufficient to raise its own weight of water to the boiling point every hour, there is here evidence of a stupendous force, the nature and power of which are unknown to us, and these are among the greatest of modern mysteries calling for future solution.

CORUNDUM IN ONTARIO.*

By D. G. Kerr.

Introduction.—The discovery of corundum in economic quantities in 1897 and 1898 by Prof. W. G. Miller, in the counties of Peterborough, Hastings and Renfrew, Province of Ontario, Canada, attracted considerable attention at that time. The corundum was found in more or less quantity along a belt of rock, about 50 miles long and from ½ mile to 3 miles wide.

The most important occurrence is in pink syenite, an acidic rock: felspar being the principal constituent, with a little white and dark mica, iron-pyrites, hornblende, 5 per cent. of magnetite, a small quantity of rubies, sapphires and garnets. The next occurrence in importance is in nepheline-syenite along the York Branch River, and it is stated that in no other country has corundum occurred in nepheline-syenite. The pink syenite carries the best corundum-ore, of a higher percentage and less impurities.

The corundum-bearing rock occurs in layers running almost east and west, dipping to the south 25 degrees from the horizontal, and at some points lying on the face of a hill exposed by glacier-action, the glacier having cleaned off the overburden, and at other points the corundum-bearing rock also, as large corundum-boulders are found many miles to the south-west, some in the valleys, while others have been left on the top of the hills. There is only a portion along a dyke exposed in this way. at another point, as the overburden was too great or a greater dip of the dyke prevented it from being all exposed.

Mines.—There are two companies working on this dyke: the Ontario Corundum Company, in Carlow township, Hastings county, and the Canada Corundum Company, in Raglan township, Renfrew county, the last-mentioned company having taken over the well known Craig mine and other deposits, covering an area of 2,000 acres in the counties of Renfrew and Hastings. At present, the works are confined to Craigmont, where the crushing and concentrating plant is situated, and corundum-ore is quarried from the southern face of the hill, 500 feet high. In some places, considerable stripping is done, of sand and gravel to the depth of 5 feet; at some points, the corundum-bearing rock crops out, showing the corundum-crystals imbedded in the rock and polished down level with the rock by glacier-action. At other points, where the corundum-bearing rock has been exposed to the weather, the corundum-crystals stand out boldly. The mineral is quarried in a series of benches up the hill, the faces running from 1 foot to 15 feet thick, and it varies in richness from 8 to 17 per cent. There are rich zones in the dyke going down diagonally south-east; in these zones, rich pockets of big nodules of almost pure corundum are found associated with crystals of white mica. Cutting through this deposit, a number of dykes are observed carrying hornblende in the same form as the corundum-crystals and readily mistaken for corundum. This dyke varies in thickness from 2 to 10 feet, when the corundum comes in again higher up the hill. In a series of little pockets of corundum-bearing ore, the width will run from 40 to 100 feet, and the ore is found in layers or in benches. The surface-rock will be ore; beneath this is a thickness of barren gneiss-rock, varying from 1 foot to 6 feet; beneath this occurs another layer of corundum-bearing ore, 3 to 4 feet thick; another layer of waste and corundum-ore follows in succession, until a depth of 25 to 30 feet is attained. A granite rock occurs below, but it has only been penetrated in three or four places: at one place, within a distance of 32 feet, no sign of corundum-ore was found.

On the property of the Ontario Corundum Company, 6 miles to the west of Craigmont, the occurrence and composition of the dyke are practically the same, with narrow bands of black micaceous schist and coarse pink pegmatite in the syenite. A rock-bluff is worked with a perpendicular face going in east on the dyke, with an average of 10 per cent. of corundum-crystals in the face.

The following analyses of corundum-crystals show the purity of the mineral:—

Sample	Alumina Al_2O_3.	Ferric Oxide Fe_2O_3.	Insoluble Matter.	Loss on Ignition.
I.	92.62	—	1.13	2.04
II.	93.29	0.36	—	1.91
III.	94.72	0.32	—	1.14

The assay-tests are made for crystalline alumina and magnetic iron and for loss on ignition. In clean corundum-crystal, a small percentage of iron, from 0.5 to 2 per cent., is found combined with the corundum.

On the property of the Canada Corundum Company, the mining is done in the usual way by means of air-drills and dynamite. The holes are drilled 14 and 15 feet deep, and a series of as many as twenty holes are sometimes fired off by means of the electric battery. A large quantity in big pieces is thrown down, and they are block-holed and bull-dosed with dynamite down to suitable sizes for handling by the cullers, as it is very necessary to cull or select the ore. The percentage of corundum does not run high enough to allow of milling all the

* A paper read before the North of England Institute of Mining and Mechanical Engineers, at the general meeting at Newcastle-upon-Tyne, October 14th, 1905.

.Payne Lower Terminal.

Noble Five Concentrator, Sandon, B.C.

ore coming from the mine, without sorting out the low grade, as the lowest grade of ore fed to the mill requires to be higher than the amount which is lost in the tailings; it is also necessary to prevent as much as possible large pieces of magnetite, iron-pyrites, or hornblende, from going to the mill, as they are difficult to remove when concentrating to 95 per cent.

In the very fine fissures, thin splashes of molybdenite (running high in molybdenum sulphide) are found, but this ore does not occur in any quantity, enough for samples only. It is stated that there is a vein of molybdenite in the neighborhood.

The drilling of the corundum-bearing rock, either by hand or by rock-drills, is not difficult; but the diorite or crystalline limestone offers greater resistance to fast drilling.

From the open quarries on the face of the hill, the ore is brought down in stone boats and trucks by teams to the tramway where it is loaded on to cars, carrying 3 to 4 tons. The cars run on a tramway into the top of the mill; before entering the mill the car-load is weighed and an exact tally kept of the number of tons which go into the mill every day (in wet weather, an allowance is made for the moisture in the ore). The cars are drawn by horses, and can handle 150 tons in 10 hours.

Mill.—The mill is situated at the east end of the southern face of the hill on which the corundum-ore is quarried. The tramway, already mentioned, comes from the weighing-machine and enters at the top of the mill: the cars are of the flat-top type and tip on both sides into the bin below. The bin is square and flat-bottomed, with a capacity of 400 tons. The shute for feeding the crusher is near the centre of the bottom of the bin, and comes out to the ore-crusher; and alongside of this shute, a man stands and feeds the crusher, of the Farrell type of Blake crusher, 15 inches by 24 inches, running at 250 revolutions per minute and crushing down to 2½ inches. The ore, after being crushed, drops on to a Robbins conveyor-belt, 18 inches wide and 85 feet long, travelling at a speed of 300 feet per minute, with 20 per cent. of an elevation to the delivery-end.

The stream of ore coming from the conveyor-belt is divided into three, and fed by short shutes into three smaller crushers, two of them being the Farrell type of Blake crushers, 6 inches by 20 inches, and one a Gates gyratory type A crusher. These three crushers reduce the ore to ¾ inch and less, and drop it into another large bin underneath of 400 tons capacity.

From the underside, at the face of the bin, the ore is fed into coarse rolls by means of a Challenge-feeder, the ore dropping from the disc of the feeder into the screen-shute and straight into the rolls; the screen taking out all fines allows the rolls to do better work. The Challenge-feeder stood below the centre of the ore -bin, and the ore was carried to the rolls by a belt-conveyor; but this was discarded, owing to the amount of ore spilled, and in order to permit of the attendant getting to the back part of the rolls so as to tighten the springs.

The ore, after passing through the coarse rolls, drops down, and is divided between two trommels, 13 feet long and 3 feet in diameter, running at 20 revolutions per minute, sloping 1 inch to the foot, the screens having 4 millimetre holes. The undersize passes downward into the vertical elevator, and the oversize passes to two sets of rolls and then into the same elevator. The elevator is an indiarubber-belt, with buckets bolted on (the buckets being 18 inches long, 6 inches wide and 6 inches deep), running at 350 feet per minute. All the crushed ore is raised by this elevator in the form of a watery pulp to the top of the mill, where it is divided into two sets of five trommels in each set. Each trommel, 3 feet in diameter and 13 feet long, 20 revolutions per minute and slope 1 inch to the foot, is driven by a sheave-pulley and rope-drive on the over-size end.

The pulp enters the two coarse trommels, the first 6 feet being covered with screens perforated with 4 millimetres holes, 4 feet with 6 millimetres holes, and 1½ feet with 8 millimetres holes. All pulp passing through the 4 millimetres holes goes to the next trommel, that passing the 6 millimetres holes goes downward to two sets of double three-compartment iron Hartz jigs; and that passing through the 8 millimetres holes passes downward through wooden spouting lined with steel-plate to a set of double two-compartment wooden Hartz jigs. The over-size, from these two trommels, goes downward to the roll-floor and, being recrushed, comes back through the same elevators. The pulp passing through the 4 millimetres holes on the first set of trommels passes to the second trommels, covered for the first 6 feet with screens having 2 millimetres holes, the pulp passing through the 2 millimetres holes goes on to the next set of trommels, and that passing over the 2 millimetres holes is sized on the next 5 feet of the trommel with 2½ millimetres holes; the pulp passing through the 2½ millimetres holes is treated on six Overstrom tables: this size is a little large for these tables, but it is done in the meantime for lack of jigs. The over-size of the 2½ millimetres holes goes downward to a double three compartment iron Hartz jig. The pulp passing through the 2 millimetres holes on the second set of trommels then passes to a third set, of which the whole length is covered with screens having 1½ millimetres holes; the undersize goes to the next set of trommels and the over-size to three Overstrom tables. The fourth set of trommel-screens has 1 millimetre holes, the under-size going to the fifth set and the over-size to the concentrating-tables. The pulp passing through the fifth trommel and the ¾ millimetre holes goes into a V box, and (the heavy particles settling) is fed to a concentrating-table and the surplus water is run into the tail-race. The twenty Overstrom and four Wilfley concentrating-tables, the two sets of double three-compartment iron Hartz jigs, and the double two-compartment wooden Hartz jigs, are placed on the floor below the trommels. The screen-area of the iron jig is 24 inches by 36 inches, and the screens are of the same sizes in the hole as the trommel which supplies the material, but the top of the screen has 1½ inches of over-size material for a head. The speed of the jigs is 220 revolutions per minute; for the fines, up to 170 revolutions per minute; for the coarser sizes, the stroke is ¾ to 1 inch.

The product of the jigs' first hutch goes to the finishing-rolls on the roll-floor below, where it is crushed and goes to bin, being finished in the crushing part of the mill; the second and third hutches of the jigs, not being so clean, go to the rolls again and are crushed finer, and, owing to the want of a separate elevator and screen, they have to go back into the main elevator where, if fine enough, they will go to concentrating-tables, and if coarse, will be returned to the jigs. Tests made on the product of the jigs showed that the first hutch cleaned it to about 50 per cent. of corundum, and the second and third hutches to 35 or 45 per cent. of corundum: that is, from an ore which carries 10 per cent. of corundum and 6 to 7 per cent. of magnetic iron. The tailings from the jigs showed a loss of 3 per cent., but, as they were much overloaded, this did not give a fair showing; and, no doubt, with ample jig-capacity, the losses would be reduced by 50 per cent.

The following is about the average percentage of corundum in the end-products:—

	Per cent.
Ore fed to mill	10½
Jig-concentrates	50
Jig partial-concentrates	40
6 millimetres screen, jig-tailings	3
4 millimetres screen, jig-tailings	3
2½ millimetres screen, jig-tailings	3
Table-concentrates	60
2½ to 2 millimetres, table-tailings	2
2 to 1½ millimetres, table-tailings	2
1½ to 1 millimetres, table-tailings	2
1 millimetre to zero, table-tailings	2
Magnet-tailings, coarse	7
Magnet-tailings, fine	3
Average	5
Rewash-table tailings	5
Total mill-tailings	5

The corundum is cleaned to 90 or 95 per cent.

On the same floor as the jigs, are the Overstrom and Wilfley concentrating-tables; and on an intermediate floor are six more Overstrom tables, to treat the middlings from the preceding Overstrom tables.

The losses from the concentrating-tables vary from 1½ to 2 per cent., principally carried off floating in the water; as, in the crushing of the corundum-crystals, owing to the hardness and the strain which is required to crush it, a percentage of the corundum goes to very fine powder and floats off in the water. The product from the concentrating-tables and the finishing-rolls is spouted into a small elevator, which raises it to another trommel for sizing, before being run into storage-tanks. No. 12 mesh is the size of screen on this trommel, and all coarser than this to No. 10 mesh is rejected, and goes back to the finishing-rolls and is crushed smaller. The corundum-concentrates are now deposited in the five storage-tanks; they are also used as filter-tanks to take off the moisture, and are fitted with a little false bottom for drainage. The corundum-concentrates, which now run about 50 per cent. of corundum, are then sent from the crushing department to the grading room.

In the crushing part of the mill, there are four sets of heavy rolls, 14 inches by 40 inches, with shafts, 10 inches in diameter, fitted with brass slieves, which slip on to the shafts and take all wear. The roll-shells are made of Hadfield manganese-steel, and do the work with very little wear, and the jaw-plates on all the crushers are made of the same material.

The Gates rolls, 14 inches by 24 inches, crush the product from the second and third hutches of the jigs. Adjacent are the Colorado or finishing rolls, 6 inches by 30 inches. There is another set of smaller rolls, but they have not been set to work yet.

The intention, when this part of the mill was built in 1903 and finished in the beginning of 1904, was to crush everything in the rolls small enough to concentrate on the Overstrom and Wilfley tables. This was found to be impossible, owing to the high percentage of fines, and the large amount carried off in the tailings in the form of fine slimes; the demand for the very fine sizes is small, and they are not so easily cleaned as the coarser sizes.

The crushing part of the mill containing the aforesaid machinery is a building 145 feet long, 36 feet wide, and 85 feet high, with five floors. On the second main floor is the machine-shop, equipped with a lathe, drilling-machine, and two small shearing machines worked by hand.

The engine-house is equipped with a Corliss engine of 225 horsepower, a Corliss engine of 125 horse-power, and an auxiliary engine of 20 horsepower.

The first engine transmits power by means of six cotton-ropes, 1½ inches in circumference, to the main shaft on the same floor for driving all the jigs and concentrating-tables, trommels and the large elevator in the top of the building, also driving all the grading machinery in the grader-building by a rope-drive from the same shaft. The other six grooves on the engine-pulley drive the main shaft for the roll-floor by means of one continuous rope with a tightener-pulley and a balance-weight. This arrangement is being taken out, as in the event of this rope breaking, all the machines on this engine are stopped until the rope is straightened out and replaced. This means a lengthy stoppage of several hours, whereas, if the ropes were all single drives, the breakage of a rope would cause no stoppage, as the other five would have sufficient power to drive the full load until the first stop, when another rope could be slipped on to it, having been prepared and spliced over the two shafts. From the main shaft of the jig and table floor, a rope-drive goes back into the engine-room to drive a small dynamo of 220 lights of 16 candlepower capacity. The little auxiliary engine runs this dynamo by means of a belt and countershaft, in the event of any stoppage of the large engine, and at the same time it runs the machine-shop for repairs.

The second engine, of 125 horsepower, runs the crushers and a small Root pump. The power is transmitted from the engine to the countershaft by a continuous manilla rope, 1½ inches in circumference, with a tightener-pulley: this also is being changed to single ropes.

In the same room as the engines, is a cross-compound air-compressor with intermediate and after-coolers, condenser, and air-receiver, having an air-capacity of 1,700 cubic feet of free air per minute and compressing it to 100 pounds per square inch, thus providing the quarries with sufficient air to run about thirty drills.

Steam is supplied to the engines from three return tubular boilers, 5 feet in diameter and 18 feet long, built up with bricks. Wood fuel is used, dry pine, maple, birch and poplar being the principal woods, the consumption amounting to 25 to 30 cords per 24 hours. The boilers are placed in a building apart from the mills.

The water to supply the crushing and concentrating part of the mill, is pumped by a Root pump from the basement of the grader-building, to a tank placed behind the first set of coarse rolls. This pump has a capacity of 1,000,000 gallons per 24 hours, and throws it against a head of 60 feet. From this tank, the water runs to the rolls, tables, jigs and launders. A jet of water is used to feed the ore into the rolls, and to keep down any dust.

Grader-building.—The grader-building is 135 feet long, 60 feet wide, and 80 feet high. The concentrates are brought into this building by a conveyor, and dropped on to a dryer.

The double-decked dryer, made of iron-pipes, 1¼ inches in diameter, is heated by exhaust and live steam. The wet concentrates are distributed from the conveyor upon a No. 4 mesh wire-screen, and as the stuff drys it drops through, on to a conveyor-belt, thence to an elevator, and is raised to the top of the building. The stream of concentrates is then divided over magnetic separators, one being of the cone and the other of the drum type. The concentrates contain 12 to 15 per cent. of magnetic iron; the non-magnetic concentrates go down to the spilter on the floor below and the magnetic iron, containing 4 to 5 per cent. of corundum, is dropped outside of the building for further treatment.

Roughing splitters, with three screens, divide the concentrates into three sizes: No. 1 takes all sizes, from 8 to 24 meshes inclusive, and sends them to No. 1 graders; No. 2 takes all sizes, from 30 to 70 meshes inclusive, and sends them to No. 2 graders; and No. 3 takes all sizes from 80 to 200 meshes inclusive, and sends them to No. 3 graders.

The roughing grader gives sizes passing through the screens; No. 1 is divided into sizes 24, 20, 16, 14, 12, 10 and 8 is over-size; No. 2 into sizes 70, 60, 54, 46, 36, 30 and 24 is over-size; and No. 3 into 200, 180, 150, 120, 100, 90, 80 and 70 is over-size. These products all go into bins above the rewashing tables and Hooper air-jigs. Steel-wire screen-cloth is used, from 8 meshes to 30 meshes; and silk screen-cloth is used for all of the other sizes, from 36 meshes to 200 meshes.

The Hooper air-jig is a good machine for concentrating dry-sized concentrates; it works well on concentrates from 24 meshes to 70 meshes, and gives four grades of produce from 50 per cent. corundum, as follow: Firsts or heaviest portion, magnetite and pyrites which have escaped the magnetic separators are extracted and sent to piles outside of the building. Seconds or lighter portion, is clean corundum 90 to 95 per cent. pure. Thirds or middlings, are held for retreatment, until a quantity is accumulated. And fourths, tailings or waste carrying off 4 to 6 per cent. of corundum. The clean corundum passes from the Hooper jigs to an elevator, which raises it to the top of the building.

Five Wilfley rewash-tables are used for cleaning up the coarse and the fine sizes. The Wilfley tables, running at 250 revolutions per minute, treat the fines, and the Wilfley table treating the coarse sizes runs at 215 revolutions per minute; the coarse tables have a stroke of ¾ inch and the finest table a stroke of ⅜ inch. The products are: Firsts, on the high side of the table, a little magnetite and pyrites. Seconds are clean corundum, 88 to 90 per cent. Thirds or middlings are retreated on the same table. And fourths, tailings or waste containing 5 per cent. of corundum.

The clean corundum from the rewash-tables is carried to the second deck of the dryer, dried and dropped down to the conveyor, taken to the clean elevator, and goes to the top of the building along with the corundum from the Hooper jigs; then it goes over the finishing magnetic separator, drops through the floor, and passes the final magnetic separator. The process leaves a corundum carrying from 1 to 2½ per cent. of iron, in the form of combined iron in the crystal corundum.

The corundum leaving the magnetic separator goes to the finishing splitters, of the same type as those already mentioned. This last operation must be carefully effected, as the exact sizing is very important to wheel-makers and users of loose corundum.

From the finishing-grader, the product drops into bins in the floor, from which it is drawn into bags containing 100 pounds. . Samples are taken from all the sizes each day, before the bags are sewn up, and as soon as the results are sent from the assay-office, the grade of quality is marked on each bag, and it is then ready to be sent to market.

Three grades are made to suit the wheel-maker. The vitrified wheel requires the highest grade, the silicate-wheel takes the next grade, and the third grade goes to the cement-wheel maker and the polishing trade. The corundum for vitrified wheels varies from 90 to 95 per cent. pure. The silicate or chemical wheel is made with silicate of soda as the binding material. The binding-materials used in the cement-wheel are shellac, indiarubber, linseed-oil, etc.

The cost of producing finished corundum, including mining, milling, concentrating, sizing, packing, office-expenses, insurance and general charges, has not yet been reduced below £8 ($40) a ton; but with a well-equipped mill, crushing 150 tons per 24 hours of a grade of ore containing 10 to 12 per cent. of corundum, the cost should not exceed £6 to £7 ($30 to $35) per ton.

THE EVA GOLD MINE.

The report of the Eva Gold Mines, Ltd., for the year ending July 31, 1906, has been published. The manager, Mr. A. H. Gracey, states:—

Work has been steadily prosecuted at the mine during the whole period with no unusual interruptions except for two days last August when by an accident one of our employees lost his life.

The mill has been running continuously except for delays occasioned by washouts referred to later.

Nothing exceptional since my last report has developed and the following tables will give full information, under their respective heads, of what has been accomplished in the different departments.

Development has been carried on as vigorously as our circumstances would permit, and the following summary shows the amount and distribution:

Drifts, 430 feet; raises, 299 feet; crosscuts, 158 feet; total, 887 feet.

The total average cost per foot was $13.51.

Distribution throughout the mine workings was as follows:—1 A drift, 245 feet; 1 A raises, 221 feet; 1 B drift, 97 feet; 1 B raises, 78 feet; 6 A drift, 78 feet; sundry crosscuts, 158 feet, and 7 A drift, 10 feet.

Mining.—The total tonnage mined and sent to the mill was 11,181 tons from different portions of the mine, as follows, while approximately 200 tons in addition are broken in stopes..

Glory holes and Stopes.

1 A Stopes	5,466	tons.
H.M. Glory Hole	1,801	"
1 B Glory Hole	311	"
5 A Glory Hole	275	"
	7,853	"

Development.

1 A Drift	1,088	tons.
1 A Raises	1,172	"
1 B Raises	692	"
Sundry Development	376	"
	3,328	"

The total amount of waste handled during the year was 1,469 tons.

With the exception of 275 tons from No. 5 A level all the above ore was transferred over both trams to the mill because it came from the upper sections of the mine. This added to the tramming cost.

Both trams worked to our entire satisfaction except that the traction cable on the main tram has not lasted as long as it should have and we are under the necessity of putting on a new cable.

Milling.—The tonnage milled is estimated by keeping count of the number of buckets of ore lowered on the tram and weighing occasionally average loads. There is a chance in consequence that the tonnage estimate is not accurate, although the discrepancy will not be serious.

According to these estimates we have put through our 10-stamp mill during the year 11,130 tons. The net running time was 336 days, making an average of 33.1 tons per day.

The total time lost was 29 days made up as follows:—

Regular monthly clean-ups	4 days	6 hours.
Flume washouts (mud and snow slides)	11 days	18 hours.
Construction pipe line	11 days.	
Sundry (inc. 1½ days on account of accident)	2 days.	
Total	29 days.	

The values recovered in the mill were as follows:—

Bullion by amalgamation	$46,925.29	per ton	$4.21
Concentrates (280 tons)	8,792.00	per ton	0.79
	$55,717.29		$5.00

The average assay value of the tailings (samples taken automatically and continuously) was 69 cents per ton. The gross value of the ore was, therefore, $5.69 per ton.

The average of the daily battery samples by assay was $5.51 per ton so that the gross recovery plus the tails loss was greater by 18 cents than the average assays showed.

The following table gives the detailed costs in total and per ton.. The per ton costs are figured on the tonnage milled. As there were approximately 11,400 tons mined the mining cost per ton would be a little less than shown in the table.

	Total.	Per Ton.
Mining	$17,808.73	$1.600
Tramming (both trams)	2,022.45	.181
Milling	7,340.55	.659
Repairs and Maintenance	1,951.56	.175
Marketing Product	3,659.28	.328
Taxes and Insurance	1,586.03	.133
Office and General	1,861.19	.167
Management	2,900.00	.260
	$39,129.79	$3.503
Development	12,141.00	1.090
New Construction	834.03	.074
	$52,104.82	$4.667

Summed up the results of the year's work are as follows:—

Bullion Recovered	$46,925.29	$4.210
Concentrates Recovered	8,792.00	.790
Sundry Receipts	845.64	.076
Total Receipts	$56,562.93	$5.076
Total Cost Operating	39,129.79	3.503
Profit	$17,433.14	$1,573

Of this profit we have spent on new development which is still an asset and on new construction as above $12,975.03, or $1.164 per ton, leaving still a balance of $4.458.11 over and above all expenditure.

Since the mill was installed there have been mined and treated 25,300 tons of ore producing $116,274.19 in bullion and $12,064.35 worth of concentrates, a total of $128,338.54, which makes an average of $5.08 per ton.

Preparations are now under way to install the first half of a Duplex Air Compressor plant which would have a total capacity sufficient to operate 15 large drills. The concrete foundations are completed and we expect the machinery to arrive by the end of September.

We have received permission to use a portion of the air pipe line belonging to the Oyster-Criterion mine, adjoining the Eva, and we have completed connections with same from our mill to the mine workings.

It is a difficult matter to make close estimates of our present ore reserves because several of the large masses are not yet completely blocked out by crosscuts and raises. However, it is safe to say, after making due allowance for this, there are considerably over 100,000 tons which little more work will make available. A complete system of crosscuts and raises from our present levels should add to the reserves a very large tonnage and this necessary work should be now under way.

Were we operating on a scale commensurate with the size and value of our ore bodies, the results would be of a much more satisfactory nature and I hope this will be a possibility of the near future.

Balance Sheet, 31st July, 1906.

Assets.

Mine		$262,795.04
Balance carried forward	$249,820.01	
Development	12,141.00	
New Construction	834.03	
Tools and Movable Plant		2,141.22
Stores on Hand		2,661.69
Boarding House Equipment		436.43
Insurance Unexpired		253.04
Shareholders' Liability		3,059.09
Sundry Debtors		121.28
Cash on Hand		7,772.07
		$279,239.86

Liabilities.

Capital Stock		$262,845.75
221,000 Shares at $1.00	$221,000.00	
68,517 Shares at .25	17,129.25	
49,433 Shares at .50	24,716.50	
Sundry Creditors		2,846.84
Profit and Loss (as per account)		13,547.27
		$279,239.86

Profit and Loss Account.

Debit.

Balance Brought Forward	$ 4,024.57
General Expense	812.94
Concentrates Charges	4,525.61
Bullion Charges	439.28
Office Expense	1,048.25
Legal Expense	86.16
Bank Exchange and Interest	16.34
Management	2,900.00
Insurance	970.00
Mining	17,808.73
Tramming	2,022.45
Milling	7,340.55
Maintenance of Plant	1,951.56
Two Per Cent. Tax	616.03
Balance Carried Forward	13,547.27
	$58,109.74

Credit.

Bullion	$46,925.29
Concentrates	10,338.81
Sundry Receipts	845.64
	$58,109.74

Nelson, B.C., 22nd September, 1906

I hereby certify that I have audited the books and accounts of the Eva Gold Mines, Ltd., to 31st July, 1906, and that the above statement represents the true position of the company.

F. W. SWANNELL,
Auditor.

The Mines Act of Ontario, 1906, requires thirty days' work to be performed within ninety days of the claim being recorded; sixty days during each of the next two years, and ninety days in the third year; or two hundred and forty days work altogether in three years and three months. The work may all be done, however, within a shorter period, if desired.

FIRST REPORT OF THE C. M. & S. CO.

The Report of the Directors of the Consolidated Mining and Smelting Company of Canada, Limited, for the six months ending June 30th, 1906, has been issued. The president, Mr. W. D. Matthews, in his address to the shareholders, says:—" The company's fiscal year has been changed so as to end on June 30th, it being found more convenient to take inventory at the reduction works at that time of the year. A number of additions and improvements are now being made to your property, which when completed will involve, including of the "Iron Mask" mine, an expenditure of about $322,000, and to provide for this expenditure and for the general purposes of the company including the further enlargement and improvement of the plant and the acquisition of new properties have under consideration the issue of capital stock out of the $801,200, still remaining of the authorized capital, as they deem it to be necessary. A by-law increasing the number of directors from 7 to 9 will be submitted to your approval."

The present board of directors consists of president W. D. Matthews, Toronto; vice-president, Geo. Sumner, Montreal; managing director, W. H. Aldridge, Trail, B.C.; E. B. Osler, Toronto; Chas. R. Hosmer, Montreal; H. S. Osler, Toronto; W. L. Matthews, Toronto; J. G. Hodgson, Montreal; Jas. Cronin, Spokane.

Managing Director's Report.

The managing director's report to his fellow directors is as follows:—

I beg to submit the results of the Consolidated Company's operations for the six months ending June 30th, 1906, including balance sheet, profit and loss account, production, and general report, with maps showing the groups of claims controlled or operated by the Consolidated Company, and vertical projections of the principal producing properties.

Financial Statement.

After writing off expenses of incorporation and $45,905.00 as depreciation upon plant and equipment, the operating profit shown is $325,854.93. From this profit a special reserve of $20,000.00 has been provided, and two dividends amounting to $234,940.00 have been paid, leaving a balance at credit of profit and loss account of $70,914.93. In determining the values of the metals and products on hand, quotations considerably lower than the market prices of June 30th, 1906, have been used, to provide against a possible decline in the metal market.

Production.

Following are the productions of the different properties controlled by the Consolidated Mining and Smelting Company of Canada, Limited, for the first six months of 1906, and the total production to date, as far as can be ascertained. It will be noted that the gross value of metals produced by the company's smelting works has been over $22,000,000, and that during the six months the gross value

Bluebell Harbour and Pier.

Monitor Mill, Brockman, B.C.

was about $3,000,000, of which $1,622,450 came from the company's own properties:—

Six Months of 1906.

	Tons Ore.	Ozs. Gold.	Ozs. Silver.	Lbs. Lead.	Lbs. Copper.	Total Value.
Centre Star and War Eagle	81,267	30,669	26,938	......	976,528	$ 823,790
St. Eugene, Ore	84,066	......	418,084	17,288,649	......	798,660
" Conc. ..	15,497	......	......	......	......	......
Snowshoe—Nil.						
	Smelted.					
Trail Smelter	157,640	64,590	1,074,255	15,133,683	2,399,161	2,994,927

Total Production Since Commencement of Operations in 1894.

	Tons Ore.	Ozs. Gold.	Ozs. Silver.	Lbs. Lead.	Lbs. Copper.	Total Value.
Centre Star and War Eagle	842,684	456,882	660,094	......	20,053,385	$12,831,033
St. Eugene, Ore.	397,482	......	2,682,273	105,459,720	......	4,489,343
" Conc. ...	88,931	......	......	......	......	......
Snowshoe	92,330	8,402	26,775	......	2,400,580	806,000
	Smelted.					
Smelter	1,068,613	508,974	9,078,833	82,288,440	25,393,446	22,014,085

Note.—Trail Smelter production does not cover period the smelter was operated by B.C.S. & R. Co., which was previous to March, 1898.

Development.

There are about fourteen miles of underground development or narrow work in the Centre Star and War Eagle and nearly eight miles in the St. Eugene. During the six months 8,573 feet have been driven in the Centre Star and War Eagle, and 6,888 feet in the St. Eugene.

In the Centre Star most encouraging results have been obtained on the eleventh or lowest developed level (1,388 feet below the collar of the shaft, and measured on the dip of vein 70 degrees).

In the War Eagle fair tonnages of ore have been found on the fourth, fifth and sixth levels, while good ore is being developed on the bottom or eleventh level (1,582 feet below the collar of the shaft, and measured on the dip of the vein 64 degrees).

At the St. Eugene the discovery of a new cross shoot, known as Fourth Avenue, connecting the main and south veins, will probably prove to be the most valuable find made during the six months at that property.

A small shoot of high-grade ore has been found in the Richmond-Eureka group at Sandon, formerly owned by the War Eagle Company, and a few carloads will be shipped as soon as raw hiding is possible.

The ore reserves have been increased in the Centre Star and War Eagle. Due to a lack of compressor capacity and drills, development in the St. Eugene has fallen behind somewhat, but the sinking of the main shaft and other important work is now well under way.

Construction and Improvement.

Due to lack of skilled labor, the new construction and improvements have not been completed.

During the six months $130,979.28 have been expended upon these accounts, which expenditure will not only reduce costs, but will increase the tonnage which can be economically handled at the mines, smelter and refinery. The main enlargements and improvements are as follows:

An increase in the electrolytic lead refinery from a capacity of fifty tons of pig lead per day to seventy-five tons per day; the installation of an electric crane, and the introduction of a new process for the treatment of the silver slimes.

The addition of a new copper furnace 22 feet long by 42 inches at the tuyeres, having a capacity of over 400 tons daily of Rossland ore.

The patent rights and installation of the Huntingdon-Heberlein process for the treatment of lead sulphides, which process is reducing the costs of treating the St. Eugene lead product, copper matte and other sulphides.

The building of additional large flues for catching dust from the copper furnaces.

Additional transformers and other electrical machinery incidental to the increasing of the capacity at the smelter and the refinery.

The principal installation at the mines consists of a new Nordberg hoist at the Centre Star, of a capacity of 1,350 tons per ten hours from a depth of 3,000 feet (cylinders 28 in. x 60 in., drums 10 feet, skips 4½ tons, horsepower 1,100), which will permit of the handling of all of the Centre Star, War Eagle and Iron Mask ore through the one shaft, in place of operating three separate shafts. In this connection the head works of the War Eagle will be abandoned, the War Eagle compressor removed to the Centre Star compressor house, where both will be electrically driven. In the new Centre Star hoist house a complete sorting and sampling plant is being installed.

New Properties.

Snowshoe Mine.

In order to secure a regular supply of desirable smelting ore, an agreement has been made with the Snowshoe Gold and Copper Mines, Limited, by which the Consolidated Company will operate that property under a lease. Reports by Professor Brock, of the Canadian Geological Survey, indicate that there are about 100,000 tons of ore which can be profitably mined, and it is believed that development work may materially increase this tonnage.

In consideration of this lease, the Consolidated Company has guaranteed an overdraft of the Snowshoe of $78,000. The proceeds from ore shipments will be applied by the Snowshoe Gold and Copper Mines, Limited, to this overdraft, so that it should be entirely repaid in about one year.

Iron Mask.

Negotiations for the purchase of the Iron Mask Mine, Rossland, have been concluded since the close of the fiscal year. This property adjoins the War Eagle on the east and the Centre Star on the north. The Iron Mask Mine shipped 19,405 tons of ore at a gross assay value of over $25.00 per ton (nearly $500,000), and has 11,850 tons of probable ore containing $20.46 gross assay value ($242,451,). The War Eagle east drifts will be connected with the old Iron Mask workings. There was considerable expensive litigation between the Centre Star and Iron Mask, which was concluded in 1901 by a somewhat indefinite agreement. The purchase of the Iron Mask removes all chance of future difficulties between the properties.

Examinations.

One or two engineers are kept in the field looking up new properties, and it is hoped that other promising properties in other districts will be secured.

Management and Staff.

Owing to personal business, Mr. James Cronin resigned the active management of the mines, and was replaced by Mr. R. H. Stewart as manager of mines, under whose supervision the mining results have been most satisfactory. The favorable condition of the company's properties are also due to Mr. Jules Labarthe, manager of the Trail Smelter and Refinery; William Chambers, superintendent of the smelter; S. G. Blaylock, metallurgist; John F. Miller, superintendent of the refinery; R. Purcell, superintendent of the Centre Star Mines; W. P. White, superintendent of the St. Eugene Mines; T. W. Bingay, comptroller, and John M. Turnbull, mining engineer.

Respectfully submitted,
W. H. ALDRIDGE,
Managing Director.

Profit and Loss Account.

To Metals and Product at Smelter, January 1st, 1906		$ 902,144 20
" Ore in transit to Smelter, January 1st, 1906		10,316 40
" Customs Ore and Lead Bullion purchased		1,893,737 36
" Freight on Ore from Company's Mines.		47,845 86
" Mining, Smelting and General Expenses:		
St. Eugene Mine	$209,924 87	
Centre Star Mine	195,743 38	
Crown Point Mine	2,294 91	
Trail Smelter	582,946 40	
		990,909 56
" Development Expenses:		
St. Eugene Mine	$ 72,297 57	
Centre Star Mine	172,321 33	
Richmond Group	557 97	
		245,176 87
" Depreciation—General Plant and Equipment		45,905 00
" Directors' Fees		2,100 00
Balance, profit		325,854 93
		$4,463,990.18
To Appropriations:		
Reserve for Claims in process of adjustment		$ 20,000 00
Dividend No. 1, paid May 1st, 1906		117,470 00
Dividend No. 2, payable August 1st, 1906		117,470 00
Balance carried down		70,914 93
		$ 325,854 93
By Sales of Smelter Product, Profit on Refining, etc.		$3,182,593 98
" Sales of Ores		127,071 22
" Smelter Product on hand, June 30th, 1906, and in transit from Smelter to Refiners—Pig Lead, Matte and Gold..		397,320 69
" Ore in transit to Smelter, June 30th, 1906, and in process of treatment at Smelter and Refinery; at cost or less estimate for refining cost		750,912 81
" Lead Bounties		1,834 17
" Rents and Sundry Revenue		4,257 31
		$4,463,990 18
By Balance brought down		$ 325,854 93
		$ 325,854 93
1906, June 30th.—By Balance		$ 70,914 93

Auditors' Report.

We have audited the accounts of the Consolidated Mining and Smelting Company of Canada, Limited, for the period of six months ending June 30th, 1906, including the Mine and Smelter Accounts maintained at the offices at Moyie, Rossland and Trail, B.C. The values attached to ores, smelter products and materials at June 30th, 1906, are as certified by managers and storekeepers, reserves having been made for contingent expenses, fluctuations in values and estimated cost of refining products in course of treatment. Subject to the foregoing, we certify that the preceding balance sheet is in our opinion properly drawn up so as to exhibit a correct view of the financial position of the company as at the date of closing the accounts to June 30th, 1906.

CLARKSON, CROSS & HELLIWELL,
Chartered Accountants.

Vancouver, B.C., August 31st, 1906.

LEASING IN THE SLOCAN.

The Review has already referred to the advantages of the leasing system, as applied to the Slocan, and we are pleased to see that Mr. S. S. Fowler, M.E., of Nelson, one of the best authorities we have, agrees that this system is one that is applicable to the Kootenays, and has so expressed himself in the course of an interview granted a representative of The Canadian.

Mr. Fowler is reported to have said:—

"The greatest and also the most obvious advantage of the leasing system is the great saving of expenditure. The mining operations of a big company necessarily involve an office staff of fair salaried men, accountant, clerks, manager and engineer. Where the authority of the manager is limited it also involves frequently costly delays in obtaining consent and approval for projected operations.

"The system has been in vogue for some years in Colorado and has been successful there. The returns of printed contracts show that the lessees pay a much higher royalty in Colorado than has so far been paid in British Columbia. There the companies usually do a certain amount of development work, sink a shaft and equip it, and start drifts. Then they lease parts of the drifts, making it a condition of the lease that the lessee shall do a certain amount of development work before he begins to stope ore.

"As to the royalties paid, the figures I have apply to two years ago, but I think there has been no material change since. The royalty is on a sliding scale, from 10 per cent. on the gross returns in the case of $25 ore to 70 per cent. for $200 ore, with the average of 45 per cent. on $100 ore. In British Columbia the rate is usually only 25 per cent. on $100 ore and calculated on the smelter returns.

"The first leases in British Columbia were generally taken on developed mines by former employees, who knew the location of small ore bodies and got leases merely to take them out, paying a small percentage of the returns. Such lessees were usually, though not always, working miners.

"That condition, however, is rapidly passing. It had many defects. Such lessees seldom had any capital. They had to work on credit, with a merchant sharing the risk, and they did no development work. The mine owners derived no benefit.

"The new condition is creating a class of lessees with small capital and usually with enough mining and business experience to satisfy the owners that the work undertaken will be well done.

"A recent contribution to the subject has advocated the formation of small syndicates, of 25 miners, each contributing $10 a month for development. Well, $250 a month will not go far to develop a mine.

"Few working miners have enough capital to really accomplish anything worth while. The lessees of the future will be men who can afford a few thousand dollars. They may then sub-lease special parts of the properties.

"It has been found that employees of a lessee do better work than men working for a big company. There is a definite object in view. They know that unless the work is successful it will stop and their occupation will be gone. In many cases, of course, where they are sub-lessees, they have a direct financial interest in the success of the work.

"Now, of course, the system cannot be followed with success in all fields. A big low-grade property—in which operation on a very large scale is necessary for profits, can only be handled by a company or individual with large capital. Even a high-grade property requiring big and costly development work, such as the long tunnel of the Rambler-Cariboo, will never, I think, be done by lessees.

"But it seems to me that the Slocan is peculiarly fitted now for successful application of the leasing system. There are many small high-grade properties already opened up, with ore bodies definitely located if not actually in sight, and many of them are equipped with mills, or are near to concentrating plants of some kind. Such properties will probably never be able to pay expenses of company operation with its costly incidentals, and pay interest on investment too, but they may give excellent returns to working lessees. If it be granted that a company manager and a working lessee are equal in efficiency, the latter has an immense advantage in economy.

"With the close supervision that is only possible with a small force, many other economies besides the saving of superfluous salaries may be effected. It is possible to see that all ore taken to the mill is clean ore, and there is every incentive to do so, as the returns depend entirely upon what is mined.

"One difficulty in the way at present is the scarcity of miners. The general prosperity of the West on both sides of the line has created a big demand for labor, and good miners are hard to get even at the highest wages.

"So far mining lessees in British Columbia have enjoyed very favorable terms. They have paid a low royalty as compared with that paid in other districts, and little in the way of development work has been required of them. There are no indications of any increase in the royalties, but the mine owners are now becoming keener as to the financial ability of the lessee to fulfill his contract, and do work that will benefit the property as well as himself and give the owner a substantial return in development as well as the small royalty, which amounts to little more, in some cases, than interest on capital already expended.

"With its limitations clearly understood and the need of economy and efficiency thoroughly appreciated, there is a splendid field in the Slocan for mining on the leasing system."

AT THE SOO.

The Lake Superior Corporation has issued its annual report for the year ended June 30, 1906. The income account compares as follows:—

	1906.	1905.	Changes.
Int. on invest. secur......	$1,102,044	$543,455	Inc. $558,589
Miscellaneous net income.	36,700	42,084	Dec. 5,384
Total income	$1,138,744	$585,539	Inc. $553,205
Coupons from 1st mtg. bonds outstanding	452,200	452,175	Inc. 25
Int. accd. 1st mtg. bonds..	37,683	....	Inc. 37,683
Balance	$648,861	$133,364	Inc. $515,497
General expenses, taxes, etc.	91,981	98,562	Dec. 6,581
Surplus	$556,880	$34,802	Inc. $522,078

The report of President Charles D. Warren to the shareholders of the Lake Superior Corporation, says:—

"During the year the important plants of the operating companies have been actively employed, and, in this direction, the expectations of your directors have been realized. It is hoped that the current year will see other of the plants in operation and that the results to the corporation will be more profitable."

Referring to the blast furnaces and steel rail plant, President Warren says: "This, the principal industry, demands the largest share of attention, and absorbs in its operation the greater proportion of the financial resources, while its further needs are inadequately met. It is most gratifying that this branch of the work shows great development and improvement. The estimated production of 150,000 tons of steel rails for the year has been exceeded by about 10,000 tons. The record output of steel rails for a day—1,004 tons—and 17,877 tons during August, 1906, shows the possibility of the plant and proves the advisability of a further capital expenditure on the steel work.

"Your directors would like to provide at the earliest possible date for another blast furnace having a daily output of at least 400 tons. This would nearly double the present production of pig iron and thereby furnish material adequate for the most advantageous operation of the rail mill. The present blast furnaces operated during the past year have made 130,902 tons of pig iron, which is considered a very satisfactory showing.

"The construction of two thirty-ton open hearth furnaces has been authorized and their completion is expected early in December, 1906. This extension will make way for the profitable use of a large amount of 'scrap' which has been accumulated, and furnish additional material needed in the operation of the rail mill. This new open hearth plant has been planned with a view to extension.

"Less ore has been taken out of the Helen mines during the preceding year. Several causes have combined to produce this result, among which may be named labor troubles and a fire which destroyed the hoisting apparatus and machine shop, all of which have since been replaced. The development work continues. Considerable bodies of pyrites have been found for which a ready market is available at profitable figures.

"The two railways and the fleet of steamers have been profitably operated, and, as in the previous year, mostly with company freight.

"The two traction companies together have shown increased business and better results. An extension of the route on the American side is under consideration. It is believed that the usual history of street railways in cities —an increase of business from year to year—will be realized from these operations.

"The Tagona Water & Light Co. has made its usual good record.

"Propositions in regard to the nickel properties from outside parties have been considered, but as yet nothing has been presented which seems worthy of acceptance.

"The Michigan Power House has furnished power to the Carbide Co. during the year. Unavoidable circumstances have delayed the construction of the works necessary to make the power house secure under the development of the maximum horsepower. It is expected that the necessary work will be under way next year.

"For the two years ending June 30, 1906, $527,883 has been expended for betterments and extensions to property and plants.

"On June 30, 1906, the total inventory of materials and supplies and outstanding accounts receivable held by the subsidiary companies amounted to $4,129,672."

THE A. B. C. OF SMELTING.

Bulletin No. 1417, an illustrated publication of 48 pages on "Smelting Furnaces and Accessory Equipments," has been issued by Allis-Chalmers Company of Milwaukee, represented in Canada by the Allis-Chalmers-Bullock Co. of Montreal. It contains information that will be of value to those who contemplate the erection of smelting plants. The pamphlet has been prepared by an expert on the subject and is as full of information as the ordinary text book on this branch of metallurgy.

"Smelting is that metallurgical process in which ores are melted or fused for the purpose of separating their valuable metal constituents from the gangue or worthless portions. It consists essentially in subjecting the ores, mixed with suitable fluxes, constituting a "charge," to the action of intense heat, whereby the "charge" is rendered fluid, the gangue combining with the fluxes to form a slag or scoria, while the valuable metals combine to form an alloy or matte. The separation of the matte and the slag takes place while the materials are in a molten condition, by reason of the difference in their specific gravities.

Smelting is performed either in a blast furnace where the fuel (coke or charcoal) is mixed with the charge, or in a reverberatory furnace in which the fuel (coal, wood, gas or oil), is burned in a fire-box adjoining the smelting chamber.

Smelting may be roughly divided into two classes: "Copper Smelting" and "Lead Smelting." As the terms imply, these mean that the predominating valuable metal in the charge is copper in the one and lead in the other. In lead smelting the valuable product is "lead bullion." In copper smelting, it is "copper matte," when sulphide ores are being treated, the "black copper" when oxide, or carbonate ores are being smelted. The lead bullion, copper matte or black copper, contains also whatever gold or silver was in the ores constituting the charge.

For smelting, the charge, or mixture, of ores and fluxes, must be of such a composition that the resulting slag will be sufficiently liquid to allow the valuable metal or its compounds to separate from the mass readily and to flow freely from the furnace. The slags produced in smelting consist mainly of silica, ferrous oxide and lime, with which there are frequently small quantities of zinc oxide, alumina and other materials. The amount of these materials in a slag are more of a commercial proposition than a metallurgical one, as the composition of a slag may be varied widely without seriously affecting the running of the furnace, or the extraction of the valuable metals.

Custom smelters buy ores of many kinds, mixing them together in proper proportions to form furnace charges of the required composition, thereby making one ore the flux for another. Independent smelters, whose own mines do not produce ores of the composition required for fluxing purposes, endeavor to secure such ores from other sources, as otherwise they would have to add barren fluxes to the charge. These cost as much to smelt as ore and give no results beyond their fluxing powers. Conditions are, however, rarely so favorable that no barren fluxes need to be added. Limestone, iron ore, and, in some cases, silicious material, are nearly always necessary to make a charge. For this reason it is desirable to locate smelters in localities where these fluxes may be easily secured.

The fuel used in blast furnaces is coke or charcoal, or a mixture of the two. Coke is preferable, as it does not crush as readily as charcoal under the weight of the charge in the furnace shaft. The quantity of fuel required by a blast furnace depends upon the character of the ore to be treated, the nature of the fuel itself and the process of smelting involved. In modern lead smelting, the quantity of coke required is, on an average, about 12 per cent. of the weight of the charge. In copper smelting with cold blast, from 8 per cent. to 12 per cent. coke is required, while with hot blast and ores running high in sulphur, as little as 2 per cent. of coke has given good results.

For reverberatory furnaces, coal, wood, oil or gas may be used as fuel. The quantity required depends upon the character of the ore, the nature of the fuel itself and the design and size of the furnace. In large, modern reverberatory furnaces using ordinary run-of-mine bituminous coal, 500 to 1,000 pounds of fuel are used per ton of ore smelted.

An important advantage of smelting is that nearly all ores, when properly fluxed, can be treated by this process. The extraction of the valuable metals in smelting depends principally upon the character of the ores, but is also largely dependent upon the man in charge of the plant. Ordinarily it is safe to figure that practically all of the gold, ninety-five per cent. of the silver and ninety per cent. or more of the lead or copper will be saved. The cost of smelting depends upon the character of the ore, the cost of coke and labor, the size of the plant and its equipment and arrangement. In some large plants, equipped with the most modern machinery and operating under very favorable conditions, a cost as low as $1.25 per ton has been attained, while with small plants in remote localities, where fuel and labor are expensive, the cost will run up to $15.00 per ton or higher.

Success in smelting is primarily dependent upon having a plant equipped with the best and most modern machinery. The arrangement of the plant should be such that ample working room is provided around the furnaces. Rehandling of materials should be avoided as far as possible, and hand labor eliminated wherever it is practicable to put in mechanical means for performing the work. A smelting plant should be carefully designed, and every condition that will influence the cost of operation should be carefully considered when the equipment is being decided upon and the plans made. It is often the case that a few additional dollars spent in equipment will mean the saving of thousands in operating expense. Even in a small plant a saving of but a few cents per ton of ore handled amounts to a considerable sum at the end of a year's run.

Plants completely equipped with Allis-Chalmers machinery can be seen in operation in every state and territory in this country where mining is followed. They are to be found in Mexico, Canada, Central and South America, Africa, China, Japan, Korea, Russia, Spain, India, Norway and in many other foreign countries. In fact, wherever there is even a pretense to modern methods in the mining or reduction of ores, Allis-Chalmers machinery may be found in operation.

We are informed by the Geological Survey that Part I, Vol. X on Temagami district, and Part H, Vol. XIV, a bulletin on nickel, both by Dr. Barlow, are out of print. No applications for these pamphlets can be entertained until new editions shall have been issued.

BOOK REVIEWS.

The Mineral Industry, founded by Richard P. Rothwell, has come to be an indispensable volume to all those who are interested in any way in the mineral production of the world. Volume XIV., covering the statistics of the industry for the year 1905, has just issued from the press of the Engineering and Mining Journal. This volume was edited by the well known authority, Walter Renton Ingalls, who is also editor of the Engineering and Mining Journal in New York.

The scheme of the volume corresponds to that of its predecessor, that is to say, it covers the field very thoroughly. In the preparation of the statistics for this volume, the figures previously reported for 1904 have been revised in the light of later and more minute investigation, therefore, it is important for students to observe the caution to use always the figures in the latest volume of The Mineral Industry. There are no statistical reports of this nature which are absolutely correct. owing to the practical impossibility of obtaining accurate reports from all the producers in some extensive and greatly subdivided industries, the absence of records on the part of many producers, which prevents them from making returns, the unwillingness of a few to give their figures, and the confusion as to the stage in which many products are to be reported. The last difficulty is especially likely to lead to errors in values, some producers estimating the worth of their product at the pit's mouth and others reporting it in a more or less advanced state of completion, including thus not only the cost of carriage, but also the cost of manipulation.

We are pleased that The Mineral Industry has returned to its original promptness of publication, though, as the editor explains, owing to this very celerity, some of the statistics may require revision, although reasonable commercial accuracy is believed to have been attained.

Two of the most important products—coal and coke—are excellently handled by Mr. Frederick Hobart, who is associated in the editing of the Engineering and Mining Journal with Mr. Ingalls.

The price of the volume is $5, and it is published at 505 Pearl Street, New York.

MINING NOTES.

With a view of meeting the growing scarcity of copper to which the recent rise in price is ascribed, several old workings in England, Wales and Ireland have been restarted. Many new shafts have been sunk in Cornwall, where it is also claimed satisfactory yields are being obtained from the coarse sea sand.

Hugh Armstrong, M.P.P., and W. Richardson, of Portage la Prairie; Dr. Willoughby, Saskatoon; T. C. Bullock, Crystal City; C. H. McNaughton, Archibald Wright, Mr. and Mrs. J. F. Campbell, Dr. and Mrs. Clark, J. R. Boland, Thomas Hurtley, S. Tupper, J. D. Fraser, and E. R. Fraser have left Winnipeg in a special car. The party intended to go to Grand Forks and thence west to Spokane, spending a day in that place, and afterwards a couple of days at the Winnipeg and Belcher copper mines.

The Iron Age says of the iron and steel outlook:—"Returns to us from the coke and anthracite blast furnaces show that pig iron production in the thirty days of September was 1,970,962 gross tons, as compared with 1,926,736 tons in August, with thirty-one days. The daily rate was 65,699 tons in September, an increase of 3,546 tons a day over the average in August. September has thus substantially checked the decline in production which has been noticed month by month since March. The weekly capacity of 310 furnaces, active October 1, was 469,665 tons; on September 1, it was 441,426 tons. A monthly increase of 120,000 tons is thus indicated.

Altogether, the sales of basic pig for delivery during the first half of 1897 amount to nearly 125,000 tons, with further inquires in the market. Eastern Pennsylvania steel makers have purchased between 25,000 and 30,000 tons, heavy melting scrap, at $18 to $18.50. Some good sales of foundry iron are reported in this section, and quite a good deal of forge iron has also been marketed. The southern iron makers do not seem to be pushing sales in any direction. Importers have been studying the chances of placing Middlesboro and Scotch irons, and some moderate business has been done. It is understood that quite a tonnage of pig iron warrants has been bought for American account, but it is yet an open question whether the buyers will take the profit available from the rise, or will ultimately decide to ship the iron. Only moderate transactions in steel rails are reported, but it is probable that some important negotiations now pending will be closed at an early date. There has been quite a good run of contracts for structural material. In bridge material the most important transaction now being closed is for 19,000 tons for the Canadian Pacific Railway. The plate makers are booking a good deal of business, and specifications are rolling in freely. In the merchant pipe trade, makers are figuring on some good orders for line pipe.

NEWFOUNDLAND.

The copper mine at St. Julien's, north-east coast, owned by Messrs. Kawaja and Parrell, has been acquired by a big New York mining capitalist, through the agency of Sir E. P. Morris, the solicitor for the owners. The deposits have been inspected by experts and favorably reported upon and the capitalists and a competent engineer will visit the colony shortly to view the property and arrange for operating it on a large scale next spring as the copper market is now up and this is believed to be one of the finest deposits in the land.

NOVA SCOTIA.

A tract aggregating 100,000 acres of land in Inverness County, was leased for twenty years by the Cape Breton Prospecting, Mining and Developing Company, Ltd., of Sydney, on October 10.

The property was acquired from Mr. W. H. Harrington, of North Lake Ainslie. The property is said to hold natural gas and oil. Twenty men are now employed, and inside of a fortnight the company expects to have all the necessary machinery installed and work going on vigorously

Land has been bonded in Inverness on which wharves and piers will be erected, the facilities for shipping being all that could be desired.

The Cape Breton Prospecting, Mining and Development Co. was incorporated under the Nova Scotia Companies' Act last April, and is composed of local men. Following are the officers: C. J. Stewart, president; Z. Tingley, vice-president; F. W. Morley, secretary; F. O. Patterson, treasurer; John P. Joy, manager. The company is capitalized at $500,000, and one of the conditions upon which the Inverness property was acquired, is that this capitalization be increased to $1,000,000.

NEW BRUNSWICK.

Mr. Einar Lindeman, who was sent by Superintendent of Mines, Dr. Haanel to examine three promising iron ore deposits in the vicinity of Bathurst, N.B., after completing his work discovered from the intensity lines of one of the deposits another ore deposit hitherto unknown of much larger extent than those he had been asked to examine. The first report is that the new deposit is 75 feet deep, 80 to 100 feet wide, and extends 1,800 feet down to the Nipissiquit River, which it crosses. This discovery is a striking exemplification of the method of examining magnetic iron ore deposits which was inaugurated by Dr. Haanel.

ONTARIO.

A discovery of copper ore is reported from the Bruce Mines, upon property until lately owned by that corporation. A vein 18 feet wide has been stripped for 500 feet. The ore is bornite and copper pyrites.

It is stated that the American Madoc Mining Company, which is working iron pyrites mines in the township of Hungerford, is preparing to erect large chemical works for the manufacture of sulphuric acid, etc. The mines are near Bogart, P.O., and at present are employing a staff of from 40 to 50 men, which will be increased from 150 to 200.

The Lake Superior Corporation will build an addition of 500 feet to its ore dock as the steel plant dock, which is now 900 feet in length, is not large enough to accommodate the business at the ore docks. An additional blast furnace is also being considered by the directors, the furnaces now in operation being unable to supply enough pig iron for the plant.

Minneapolis is to be directly interested in new and extensive mining operations to be started in Canada on Lake Superior next spring. R. J. Anderson of Minneapolis, is in charge to-day, with E. V. Douglass.

The Lake Superior Company will take all the ore that the new company can mine. It is to be known as the Thunder Bay Iron Co.

St. Paul capitalists have taken an option on 6,000 acres of iron ore property at Loon Lake, Ont. They will commence development work this fall, erecting a large number of shanties to house sixty men during the winter. It will be one of the largest iron ore camps in the world in a short time, so Port Arthur people have been assured. Ore docks will also be built this year.

Strange, weird stories, which rival the wildest dreams of imaginative depicters of adventure in forbidding places of the world, are told by returning prospectors from the north. According to report there are scores of men wandering around in the woods, over rocks and cliffs, by river and lake, treading where white man has hardly gone before, all in search of signs of mineral. With the passion for wealth, mingled with a craving for excitement, the chase is persistently kept up. Some of these prospectors lack even a common woodsman's experience, and numerous instances are recorded where men were found in a starving condition, miles from any human habitation. Sometimes they even forsake their canoes and take to the woods in a vain effort to meet a fellow-man. A story was told in New Liskeard by a man named Albert Connell

La Plata Mine and Terminal of Upper Tram.

La Plata Mill and Tram.

about a prospector who became so weak that he was unable to carry his rifle, but who was rescued in the very nick of time. What proportion of these stories is true it is impossible to tell.

Mr. E. D. Ingall, mining engineer of the Geological Survey, has just returned from a tour amongst the copper mines of northwestern Ontario. The conclusions at which he arrived will shortly appear in the department's summary report, but meanwhile it is no secret that Mr. Ingall was considerably impressed by the renewed activity in the copper districts, due to a large extent to the present high price of that metal, but also to their being more easily accessible than formerly.

Mr. Ingall says that prospecting for copper ores is just now very active and that development and exploratory work are being prosecuted at a number of points along the north shores of Lakes Huron and Superior.

Underground development is being actively continued at the Tip Top Mine, near Lake Shebandowan, west of Thunder Bay, as well as at the Heminia, Dean Lake, Superior, Echo River, and at various points distributed along the the range of country lying adjacent to the north shore of Lake Huron and between the well known nickel-copper district of Sudbury on the east, and the eastern shores of Lake Superior.

The wide distribution of copper ores throughout this region was pointed out in the earliest publications of the survey and interest attaches to the recent reopening of the Bruce Mines series of veins. These were operated as far back as the year 1847 and mining was successfully continued for a period of some twenty-eight years when the difficulties due to their isolated situation and the drop in the price of copper caused a cessation of mining. Now, after a long period of rest and various vicissitudes these old and interesting mines are being reopened by an English company and it is believed that, with higher prices for the product, together with the great improvements in methods and machinery and in the general conditions of this district, operations can be carried on with profit.

The already proved prevalence of copper ores over so extensive a territory, together with the present activity in exploring and the promising nature of some recent discoveries justifies the hope that the problem of profitably treating the sulphuret ores of north-western Ontario will be solved at an early date.

The discovery of gold on Larder Lake, north of New Liskeard, is now confirmed. To Dr. R. Reddick, who comes from Winchester, Ontario, goes the credit for the discovery of this new field, though the first actual find was made by Mr. Edward Flynn of Chesterville. Dr. Reddick has just returned from the north, and told a correspondent of the Globe this story. After describing how he obtained preliminary information concerning gold the doctor said:—

"On the 13th of July last John Hummel of Hilliardton, Edward Flynn of Chesterville, and William Knott of Hilliardton and myself started from Haileybury for the north to prospect for gold. We left Tomston on the 16th and arrived at Larder Lake by trail and canoe on the 20th. Immediately we commenced to prospect, and we received many discouragements. Prospectors were returning with stories of barren rock. I knew gold had been found at Opisatita, in Quebec, and accordingly we moved as near to the boundary line as possible. We also knew gold had been found, though in uncertain quantities, in Boston and Playfair townships, west of Larder Lake. We got in a line between Opisacita, and these finds, which turned out poorly. On July 29 we found the first signs of gold while on our way to visit Chamoney, Quebec. There was only a speck of gold rose quartz. Ed. Flynn found the first sign. Two days afterwards a large body of this quartz was found by myself on the north side of the north-east arm of Larder Lake. Actual gold was found on the last day of July. I named the rock formation Reddick Lode. There had been one claim staked near there for copper, but there was one full claim between this stake and where the gold was found. I named my first claim the Annie R. Gold was visible in quartz, and we could knock this off with our picks. I will admit we were somewhat excited, and four or five assays were made. This will run from $122 to $1,868 in gold per ton of quartz. All we staked were seven claims. Gold is treacherous. I know that by experience, and we said to ourselves seven claims would be sufficient, and if good there would be enough returns for us all. Other parties from Chesterville followed us, and they were Herman Hummel, W. G. Barkley, J. T. Kearns, and W. J. Elliott. You can imagine that we never sought any publicity, because secrecy is the best thing in such cases, and this is the first time I ever told this story, knowing that it would reach the world. I am certain whereof I speak."

COBALT.

The town of Cobalt still continues to be overcrowded by representatives of leading mining firms of America. and their friends. The town has also many visitors, who come up to inspect the Nipissing and other properties in which they hold stock.

An interesting incident in connection with the rich LaRose mine occurred recently when the owners sold the dump or refuse ore at $25 per ton, a transaction which will net, at a conservative estimate, $250,000. The dump ore will be taken to Providence, R.I., for treatment.

The Buffalo mine is showing up excellently, and there is a steadily increasing output of good quality ore from its working veins. The Cobalt Silver Queen is fast coming into line as one of the good shippers of the camp, and the Trethewey properties are in better working order than ever.

The Hudson Bay have given an option of one million dollars for the 200 acres of land they held after the sale of the Silver Queen. This price, however, does not include any of the assets of the company, other than the unproven ground comprising the 240 acres, so it will not be surprising if this deal is not consummated.

Asked as to his opinion relative to the depth of the silver-bearing veins in the district, Mr. John Hayes Hammond is reported to have said that there seemed to be no question as to their deep-seated origin, and added that there was every probability that they would continue to hold approximately their present values for several hundred feet.

The shaft of the Silver Queen is now down 140 feet, and at the bottom of the shaft they have 18 inches of high-grade ore. The Silver Queen is looked upon as one of the soundest propositions of the camp, but it is to be regretted that more of the surface of its property has not been prospected, for, since the big vein was first discovered, it has monopolized the attentions of either set of owners.

Mr. E. T. Corkill, mining inspector, has returned from the Gillies Limit and reported on the progress of prospecting to the Department of Lands, Forests and Mines. The entire attention of the engineers is being devoted to trenching. The 75-foot shaft alongside the newly-discovered vein, ordered by the Government has been sunk about 30 feet, and will be finished about the first of December. Regarding the reports that prospectors had discovered numerous veins, Mr. Corkill stated that if they did they never produced the goods. The Government engineers, he said, had discovered a dozen or more likely veins which were not reported to the Department. The health of the camp is excellent.

In the Kerr Lake district the Drummond property is perhaps the largest shipper in point of tonnage, although some of this ore is not so high grade as that which is shipped from the immediate vicinity of Cobalt Lake. The Foster property is now in much stronger hands and shipments from it will show considerable increase during the winter months. Everything on the property is in good shape for the winter.

A company known as the Cleveland Cobalt Mines, Limited, is being organized and has taken over several of the claims in the vicinity of Clear Lake. On some of the holdings of the new company there are calcite veins carrying a very fair percentage of silver, and it is not improbable that the Clear Lake district will swing into line next summer as a shipper. Considerable diamond drilling has been done on several of these properties.

Stoping on the Lawson Vein Extension of the Silver Leaf has been commenced, and there is reason to believe that from one to two cars a week of high-grade ore will be taken down and shipped. Arrangements are being made for machine drills to work in the end of the drift, continuing to block additional ore, so that these shipments should be continuous when started—which will probably be not later than the middle of November.

Mr. W. R. Smyth, M.P.P. for Algoma, a member of the company owning the Nancy Helen mine, in the town of Cobalt, says the shaft-house, sleeping-house and other buildings at the mine are finished, twenty to twenty-five men are constantly at work, and two carloads of high-grade ore are awaiting shipment. The company has recently purchased a claim, which is regarded as a most excellent one, in the township of Buck, and will soon commence mining operations on it.

The Nipissing's air compressor is on the ground, and being installed, and it will be in working order about the first of the year. The main shaft is now down about 40 feet, in the vein, commonly called the big Bonanza, and it is the intention of the management to rush this to the first level with all speed that levels may be run, and stoping undertaken. Vein 27 of this property, which is also a remarkable vein, were it not overshadowed by the gigantic values shown on 49, is producing ore right along, and it is the intention of the management to sink on this vein also. This vein has been turning out some remarkable specimens of wire silver and other forms of the white metal of scientific interest.

Guggenheim interests, which are already the largest silver products in the world, have acquired control of the Nipissing mine at Cobalt, Ont. The Guggenheims have committed to the Cobalt silver field for some months a corps of their engineers, including John Hayes Hammond, who returned only a few days ago from an extended investigation of their property, and on the basis of their report the Guggenheims closed on Oct. 30 an option on 400,000 shares at $25. In addition to the block of stock acquired, amounting to one-third of the capitalization, the Guggenheims are said to have acquired sufficient stock to give them control. It is believed they will make other acquisitions in Cobalt district.

A new silver field district, and at a considerable distance from that of the Cobalt district, is the possibility opened up by the finding of silver in the Temagami forest reserve. The discovery was made at a point in the southwest angle of the township of Auld, where twelve claims have been already staked, all but one of them on discoveries of cobalt. The exception is a claim held by the White Brothers, of Muskoka, and it is reported to contain large quantities of native silver, similar in quality to that of the Larose and Nipissing properties in the Cobalt area. The White brothers broke several specimens from a thirty-pound lump of ore on top of a silver vein and these were found to contain a large percentage of native silver. The new field is reached from a point on the Montreal River, about twenty miles from Latchford, thence overland fifteen miles. As all the smaller lakes in the district are now frozen over, it will be a difficult matter to get into the new field before next spring.

ALBERTA.

Captain Walker of the Royal North-West Mounted Police has arrived in Edmonton from a four months' trip in the country between Lake Winnipeg and Hudson's Bay, where he has been establishing police posts, which will keep up monthly communication between the two bodies of water. Patrols will also connect with the C. N. R., which is being built toward James Bay. The distance from Norway House to Churchill is close to 500 miles. Captain Walker believes that the James Bay country has great mineral possibilities, and prospectors are already going into that country from Winnipeg and Ontario points. Fort Churchill is also reported to have unlimited coal fields.

BRITISH COLUMBIA.

The new machinery for Slough Creek, Limited, is arriving slowly. Its installation has been much retarded by the heavy rainfall during the month of September. Work in the drain tunnel proceeds as rapidly as the difficult character of the ground will permit.

The month of September was very wet in Cariboo, and most of the hydraulic mines about Barkerville got a satisfactory fall piping with which to augment the clean up next summer. August was a dry month, the rainfall being only 1.16 inches, while the precipitation for the first 27 days of September was 7.38 inches, according to the weather record of Meteorological Observer James Stone.

According to the Toronto News of October 27th, there was a meeting of Granby directors this week, and a rumor arose that several of the largest stockowners had sold out, giving the control to new and less reliable interests. A diligent canvass of directors and officers resulted in establishing the fact that nothing of the kind has taken place, nor is any change in control considered even remotely possible. Granby has had a clean record under its present control, and as any change would undoubtedly cause uneasiness among stockholders, it may be well to give the emphatic denial obtained yesterday.

Mr. R. T. Ward, a director in the Beaver Valley Oil Company, is down from Horsefly. He says the machinery for boring is all on the ground and in the course of installation. The pipe has not all arrived yet, but is expected to be on the ground by the time it is needed. Mr. Ward has disposed of his boring machine to the P. Burns Syndicate, who own 60 miles of dredging ground on the Fraser river, extending from Big Bar to the mouth of the Chilcoten river. Mr. Kirkwood, the manager for the syndicate, said that as soon as he had tested the ground several big dredges would be set to work. Mr. Kirkwood is a well known engineer of New Zealand, and for several months past has been operating dredges at Lillooet and Lytton.

YUKON.

Two hundred samples of quartz were put through the government assay office at White Horse the last six weeks. The demand on the office for assays is constant and heavy.

Governor McInnes states that while there is no government assay office in Dawson, all Klondikers are at liberty to send quartz samples to the White Horse assay office for testing. No charge is made for the test. An assay office was formerly maintained at Dawson, but has been closed, and all the territorial assay work is done at White Horse.

The new strikes in the Conrad, Watson river and White Horse districts have kept the prospecting fever high. While the quartz enthusiasm has abated near Dawson, it has augmented near White Horse. Considerable interest also is maintained in the copper properties near White Horse. Some of the heaviest development work yet undertaken there is now under way.

Col. Budd, manager of the English Company, which recently bought several miles of Walker's Fork property for dredging purposes, states that 450 tons are being shipped by his company to Fort Cudahy, at the mouth of the Forty-Mile.

"I plan to have this dredge placed on the Walker's Fork property this winter," says Col. Budd, "and to get three more dredges for the ground this winter. The present dredge has a capacity of 3,000 cubic yards daily, but I should like to get three more for next year."

COAL NOTES.

NOVA SCOTIA.

The October output of the Dominion Coal Company was 350,009 tons. The shipments were 337,139 tons.

The Cumberland Railway & Coal Co.'s shipments from collieries for the month of October were 32,221 tons.

The Dominion Coal Company's output for the month of October surpasses any previous record for the company by several thousand tons, and reaches the high total of 350,009, as compared with 323,732 in September. This in spite of the loss of coal at Reserve on account of the destruction of the bank-head. No. 1 being double-shifted in some sections, increased the output. There was a gain, however, all along the line. Labor is now much more abundant than during the summer.

The Maritime Coal Company will introduce an electrical plant near their coal mines, seven miles outside of Amherst, N.S. Here they will generate electricity and supply the big manufacturing and other concerns in Amherst.

Senator Mitchell, president of the Coal Company, has signed a contract with the Canadian Westinghouse Company for the supplying of apparatus. This company will install a 750-horse power generator and transformer and other necessary apparatus. The coal will be burned in furnaces right alongside the mine, and the electricity generated at that point. The power line is nearly finished, and the plant will be complete and in operation before the first of the year.

The electric current will be carried to Amherst on a high tension wire, and it is possible that within a short time the power will be carried on to Moncton, a distance of forty or fifty miles. It will be then supplied to towns within a radius of seventy-five to one hundred miles of the central station, situated at the mines outside of Amherst.

It is reported semi-officially that the Dominion Coal Company have acquired over two hundred acres of land near Lingan and Barrasois, Cape Breton. Evidence for months have pointed to the opening of a mine in the neighborhood, as for instance, surveys and work started to build a branch railway from the S. and L. main line. The land referred to above overlies three valuable seams of coal. The Barrasois seam, which crops at the seashore and is 9 feet thick; the Victoria seam, 200 feet farther down, which is 7½ feet thick, and Lingan seam 480 feet below that again. All these seams were worked to some extent years ago—notably the Victoria seam which produced a fine domestic coal. Lingan seam coal is a specially valuable cooking coal. The Barrasois seam is believed to be a continuation of the seam on which the Hub colliery is being worked. Those who should be in a position to know state that a new colliery will be opened up in the neighborhood above indicated not later than next spring.

The company have a force of men at work on the new shipping piers here and should have them completed and ready for shipping coal inside of two months. The shipping pier is 250 feet long, will contain two tracks, one for full cars with a transfer table to shift empties to the other track. The fulfilment of the long-talked-of project will add materially to the prosperity of this section of the town along the harbor front.

Dominion No. 6 colliery is now producing 600 tons of coal per day and will produce 1,000 per day very early in next season.

THE MINING AND INDUSTRIAL SHARE MARKET.

(Specially reported for the CANADIAN MINING REVIEW by ROBERT MEREDITH & Co., Mining Brokers, 57 St. François Xavier St., Montreal.)

The market for British Columbia mining stocks is now almost entirely controlled by operatives in the Far West. A great deal of stock has been bought in this market and shipped West during the past month, notably International Coal, Denoro and California.

The local interest has gone into the Cobalt region, and aided by the activity of these stocks on the "curb" market in New York, prices have advanced very sharply.

In the industrial stocks, the most active has been Dominion Iron & Steel. The business of the company has been increasing considerably, and the stock moved in sympathy with it, but the recent difficulty with the Coal Company has given it a bit of a setback. There has been a quiet absorbing of the bonds of this company, presumably for investment purposes.

The report of the Consolidated Mining & Smelting Company, just published, is an indication of the steady improvement in mining, in the western province. It is an interesting document, and an evidence of the success of consolidation in reducing the cost of production.

The latest quotations are as follows:—

	Bid.	Asked.
Consolidated Mines	137	140
Can. Gold Fields	7½	8¼
Granby Consolidated	13¼	13½
Rambler-Cariboo	29	32
North Star	13	18
Monte Christo	2½	3½
White Bear	9½	11
California	5½	6½
Virginia	5	6
Deer Trail	...	2½
International Coal	65	68½
Sullivan	10	12
Jumbo	17	18
Cariboo-McKinney	4	5
Denoro	9½	15
Novelty	3½	4¼
Diamond Vale Coal	17	20
Dominion Copper	6	6¼
Dominion Coal (com.)	63½	65½
Dominion Coal (pref.)	114	115
Dominion Iron & Steel (com.)	28	28¼
Dominion Iron & Steel (pref.)	76	78
Intercolonial Coal (com.)	...	...
Intercolonial Coal (pref.)	...	...
Nova Scotia Steel & Coal	67	69
Nova Scotia Steel & Coal (pref.)	...	...

INDUSTRIAL NOTES.

A branch of the Bank of British North America has been opened at Darlingford, Manitoba, under the management of Mr. C. C. MacRae.

The Jeffrey Manufacturing Company, Columbus, Ohio, have established a new Canadian Branch Office in Montreal, at Lagauchetiere and Cote streets.

The Canadian Copper Co., of Copper Cliff, has bought from Allis-Chalmers-Bullock, Limited, Montreal, a pumping plant, consisting of an 8-inch single stage turbine pump, driven by a 70 h.p. induction motor.

The Calumet Mining and Milling Co., Calumet, Que., has increased its plant by a 12¼ in. by 18 in. "Ingersoll" air compressor, driven by a 50 h.p. induction motor, both bought from Allis-Chalmers-Bullock, Limited, Montreal,

The Northern Pyrites Company, of Dinorwic, Ont., has bought from Allis-Chalmers-Bullock, Limited, Montreal, a mining plant, consisting of a one-half duplex "Ingersoll" air compressor, "Ingersoll" rock drills, "Lidgerwood" hoisting engine, boilers, ore buckets, etc.

The Ontario sales office of the Jenckes Machine Co., Limited, has been removed from 12 Lawlor Building, Toronto, to St. Catharines, Ont., where it will in future be operated in conjunction with the extensive branch works of the Company there. Mr. W. G. Chater, as formerly, will be in charge.

Among recent sales of crushing plants by Allis-Chalmers-Bullock, Limited, of Montreal, were a No. 6 Gates "K" breaker, complete, with a 40 h.p. engine, to Wallace & Sturtevant, Bancroft, Ont.; a "D" breaker, set "B" "Gates" tube mill, "Reynolds" Reliance Corliss engine, boiler, elevators, etc., to the Commercial Cement Co., of Rose Isle, Man.; and a "Dodge" crusher with "Gates" elevators, etc., to the Western Canada Cement & Coal Co., Limited, Exshaw, Alta.

The Canada Forge Company have begun the construction of their buildings at Welland, the contractors being the Welland Construction Company, who also have the construction for the buildings for the Ontario Iron & Steel Company, having been working on them for some time. The Forge Company will construct two buildings about 50 x 100 feet each, to be completed by November 15; other buildings will be added. They will begin manufacturing early in January. Electrical power will be installed at once, using about 75 horse-power. The capital of the company is $100,000.

The Iberville Lumber Co., whose headquarters are in New York City, are establishing a large saw mill at Sault-au-Mouton, Que., a point on the north shore of the St. Lawrence, some distance below Quebec. The contract has been placed with the Jenckes Machine Co., Limited, of Sherbrooke, covering the turbine plant to furnish power for the saw mill. This plant consists of two 20 in. special Crocker turbines, each developing 200 h.p., one special 15 in. Crocker turbine, developing 100 h.p., all operating under 52 ft. head. The three turbines are horizontally set in one large steel case to which the water is conducted through a steel penstock, 4ft. in diameter by 150ft. long. All of the turbines are of the cylinder gate type. Mr. A. N. Mercier, of Quebec, is the Superintendent of the Company.

The Maine & New Brunswick Electrical Power Co., which is developing a water power at Aroostook Falls, New Brunswick, have awarded contracts for the necessary equipment. The turbine plant will be built by the Jenckes Machine Co., Limited, Sherbrooke, Que., and will be composed of two 900 H.P. units, each consisting of a pair of special 21 in. cylinder gate Crocker turbines, each pair mounted on a cast iron draft tube discharging centrally set in concrete flume and running 600 R.P.M. under 72 in. head, developing 80 per cent. efficiency at full gate. The turbine runners are cast bronze and the construction throughout is of the most substantial character. One Lombard type "P" water wheel governor will be attached to each unit. A steel Penstock 6ft. 6in. diameter by 75ft. long, conveys the water from forebay to each unit. Each unit will be direct connected to a generator, the order for which was placed with the General Electric Co., Schenectady, New York. The headquarters of the Maine & New Brunswick Electrical Power Co. are at Presque Isle, Maine, and the order for the turbine plant was placed in Canada only after the most thorough investigation and comparisons with the product of American turbine makers who were tendering.

The Jeffrey Manufacturing Company, of Columbus, Ohio, have established a Canadian agency at the corner of Cote and Lagauchetiere streets, Montreal, with Mr. A. G. Walker, formerly with Williams & Wilson, in charge, and are ready to supply all kinds of chain, elevating, conveying, crushing, screening and power transmission machinery.

They intend to carry a stock of standard material, such as chain, sprockets, buckets, adjustable take-ups, pillow blocks, collars, spiral conveyors, elevator roots, etc., and are prepared to make up promptly a reasonable line of other conveying and elevating specialties.

Estimates, plans, information and prices will be furnished to all prospective buyers on application. With 25 years' experience they are prepared to furnish labor-saving appliances of the latest and most efficient construction.

A large and handsome catalogue of 370 pages will be mailed to those who desire information, with a view to purchasing. This Company also issues sectional catalogues and circulars, covering labor-saving devices, for different industries, such as cable conveyors, log, lumber, and refuse conveyors, belt conveyors, spiral conveyors, brick conveyors, bucket elevators, link belting, coal-washing machinery, coal mining machinery, crushing machinery, screening machinery, electric locomotives, etc., any and all of which will be sent cheerfully to interested parties.

The efficiency and popularity of Allis-Chalmers crushers and cement grinding machinery has once more been demonstrated by the receipt from Dr. Irving A. Bachman, acting for the Santa Cruz Portland Cement Company and for the Atlantic Portland Cement Company, of the largest single order for cement machinery equipment ever placed by one man at one time in the history of the cement-making industry of this country.

Allis-Chalmers machinery, which was furnished in 1901 to the Standard Portland Cement Company at Napa Junction, Cal., and which consisted of crushers, ball mills and tube mills, has been in continuous operation since then, giving such uniformly good satisfaction to Dr. Bachman, that in October, 1905, he placed the initial order for the Santa Cruz Portland Cement Company's equipment. There were included in it a No. 9 crusher, two No. 6 crushers, sixteen No. 8 Gates ball mills and twenty-two 5½ ft. x 22 ft. Gates tube mills.

Due to the increased demand for cement products on the Pacific Coast, following the destruction of San Francisco, the Santa Cruz Company has now ordered, through Dr. Bachman, an equipment which is practically a duplicate of the one already in service.

Owing to the successful operation of the Standard Portland Cement Company, which was Dr. Bachman's initial Pacific Coast venture, a number of San Francisco capitalists having come to have strong faith in the future of the cement industry on the coast, decided to put additional plants into commission. For this purpose, the Atlantic Portland Cement Company was organized and has ordered Allis-Chalmers equipment, consisting of a No. 9 crusher, four No. 6 crushers, twenty-two No. 8 Gates ball mills and twenty-six 5½ ft. x 22 ft. Gates tube mills.

MINING INCORPORATIONS.

NEW BRUNSWICK.

The Northfield Coal Company, Limited, head office, Northfield, Sunbury County, N.B. Capital, $20,000, divided into 20,000 shares, of $1 each. Incorporators:—James Barnes, M.P.P., of Buctouche, in the County of Kent, N.B., contractor; Charles J. Osman, M.P.P., of Hillsborough, in the County of Albert, manufacturer; James Kennedy, of Adamsville, in the said County of Kent, accountant; Edward Barnes, of Buctouche aforesaid, farmer; and Alexander P. Barnhill, of the city of Saint John, barrister-at-law.

QUEBEC.

Canadian Primelectro Company, Limited. Head office, Montreal. Capital, $1,000,000, divided into 10,000 shares of $100 each. Incorporators:—Arnley Quackenbush, M.D., Ottawa, Canada;. Geo. G. Roe, Ottawa, Canada; Wm. Robertson, Montreal; Stephen L. Tingley, Providence, R.I., U.S.A.

ONTARIO.

The British American Oil Company, Ltd. Head office, Toronto, Ont. Capital, $200,000, divided into 2,000 shares of $100 each. Incorporators: William Austin Manion and Albert LeRoy Ellsworth.

The Superior Dock, Coal and Metal Company, Limited. Head office, Sault Ste. Marie, Ont. Capital, $75,000, divided into 750 shares of $100 each. Incorporators:—Francis Andrew Lucas, John Niven Oldham, and Agnes Spencer.

The Canadian Refining Company, Ltd. Head office, Ottawa, Ont. Capital, $2,000,000. Incorporators:—Henry Roy, Ottawa; F. N. Bolt, Rossland; J. J. B. Gosselin, Notre Dame de Stanbridge, and J. J. Fleutot, Frank, Alberta.

The Volcanic Oil and Gas Company, Limited. Head office, Chatham, Ont. Capital, $300,000, divided into 300,000 shares of $100 each. Incorporators:—Dennis Alexander Coste, Henry David Symmes and Joseph Thomas O'Keefe.

The great Central Oil and Gas Company, Ltd. Head office, Petrolea, Ont. Capital, $100,000, divided into 4,000 shares of $25.00 each. Incorporators: Herbert Etsel Crandall, John Wilfred Craise, De Witt Clinton Corey, Fred. Ashel Ansell, and Dinnett Ross Lovejoy.

Canada Minerals, Limited. Head office, Toronto, Ont. Capital, $100,000, divided into 1,000 shares of $100 each. Incorporators: William Bledden Bentley, Austin Russel Campbell, David Forbes Keith, Norman King Wilson, Maud Eva Crossley, all of Toronto, Ont.

The Larder Lake Gold Mining Company. Head office, Haileybury, Ont. Capital, $500,000, divided into 500,000 shares of $1 each. Incorporators:—Gordon McMurdo Petrie, druggist, and Frank Potage, and Percival John Montague, students-at-law, all of Toronto.

Pittsburgh Coal Company, Ltd. Head office, Port Arthur, Ont. Capital, $100,000, divided into 1,000 shares of $100 each. The provisional directors of the company to be James Steller Lovell, Robert Gowans, Ernest William McNeill, William Francis Ralph and Walter Gow.

Watts Mines, Limited. Head office, Toronto, Ont. Capital, $1,000,000, divided into 1,000,000 shares of $1.00 each. Incorporators: William Ruston Percival Parker, George McPhail Clark, John Alexander McEvoy, Gordon Russell and Ethyl Mabel Lindsay, all of Toronto.

The Progress Cobalt Silver Mining Company, Ltd. Head office, Cobalt, Ont. Capital, $500,000, divided into 500,000 shares of $1.00 each. Incorporators: Simon Peter Myers, Matthias Koch, Harris Wener, Gustave Orban, Harris Cohen, Archie Henry Jackson, all of Montreal.

The Nancy Helen Mines, Limited. Head office, Cobalt, Ont. Capital, $500,000, divided into 500,000 shares of $1.00 each. Incorporators: John Ferguson Black, of Sudbury, Ont.; Wm. Howard Hearst, John McKay, James Leland Darling, Robert Henry Knight, all of Sault Ste. Marie, Ont.

The International Cobalt and Silver Mining Company, Limited. Head office, Sault Ste. Marie, Ont. Capital, $500,000, divided into 500,000 shares of $1.00 each. Provisional directors to be George Kemp, Don Hernando Jacobi, Charles Frank, Samuel Frank and Frederick Niebuhr.

The Wet Process Reduction Company, Ltd. Head office, Toronto, Ont. Capital, $1,000,000, divided into two hundred thousand shares of $5.00 each. Incorporators: Geo. Edward Kingsley, Chas. Bagot Jackes, Herbert Morley Asling, Geo. Henry Bostock and Andrew Eadie, all of Toronto, Ont.

The Barron Brick Company, Ltd. Head office, Toronto, Ont. Capital, $50,000, divided into 1,200 shares of $50 each. Incorporators: William Wallbridge Vickers, Romeyn Lawyer, and Alexander Ritchie, of Toronto, Ont.; Alfred Ernest Barron, of Chicago, Ill., and George Plant, of Weston, Ont.

The Golden Park Mining Company, Limited. Head office, Windsor, Ont. Capital, $100,000, divided into 100,000 shares of $1 each. Incorporators:—Albert Van Schinck, agent; Charles Pohliman, manufacturer; James William Keenan, merchant, and Humphrey Eugene William, cabinet-maker, all of Detroit, Mich.

The Colonial Mining Company, Limited. Head office, Cobalt, Ont. Capital, $100,000, divided into 100,000 shares of $1 each. Incorporators:—John Shilton and William Halloway Wallbridge, barristers-at-law; James Charles Macklin and Charles Edward Kelly, accountants, and Frank B. McLean, appraisal agent, all of Toronto.

The Komnick System Sandstone Brick Machinery Company, Ltd. Head office, Toronto, Canada. Capital, $100,000, divided into 1,000 shares of $100 each. Incorporators: Robert Farquhar Kellock, of Perth, Ont.; Chas. Thomas Gordon Croft, Geo. Townsend, Herbert Lynn Douglas, Chas. Wilkinson, all of Toronto, Canada.

The Erie Natural Gas Company, Ltd. Head office, Dunnville, Ont. Capital, $40,000, to be divided into 400 shares of one hundred dollars each. Incorporators: William Webster Krick, Frederick Morton Waines, Arthur Abraham Root, all of Dunnville, Ont.; Absalom Hoover, Abraham Hoover and William Thomas Henderson.

The Silver Lion Mining and Development Company, Ltd. Head office, Cobalt, Ont. Capital, $500,000, divided into 2,000,000 shares of 25 cents each. Incorporators: Francis Watt, of Toronto; John Black, of Cobalt, Ont.; Alexander Goodsir Fowler Ross, Robert Thomas Mullin, of Montreal, and Will Hale Potter, of Niagara Falls.

The Canada and the United States Oil and Gas Company, Ltd. Head office, Chatham, Ont. Capital, $30,000, divided into 300 shares of $100 each. Incorporators: Edmund Isaac Barnard, John Wm. Shay, of Pittsburgh, Mass; Philip William Roth, Frank Basden Barnard, of Buffalo, N.Y., and Russel James Straight, of Bradford.

New York and Ontario Oil and Gas Company, Ltd. Head office, Chatham, Ont. Capital, $30,000, divided into 300 shares of $100 each. Incorporators: Philip William Roth and Frank Basden Barnard, of Buffalo, N.Y.; William Lewis Norton and Luther Sprague Church, of Wellsville, N.Y., and Nolan Herbert Bowlby, of Chatham, Ont.

The Two Lakes Copper Mining Company, Ltd. Head office, Sowerby, Ont. Capital, $500,000, divided into 500,000 shares of $1 each. Incorporators: Clarence Webster Coulter, Louis Lourie Lucas, James Plews Russell, John Crawford Wilkins, Donald George Bailey, Frederick Watson Bailey and Stephen Ludlum, hereinbefore mentioned.

The Heathcock Mining Company, Limited. Head office, Dresden, Ont. Capital, $100,000, divided into 100,000 shares of $1 each. Incorporators:—Isaac Benjamin Webster, broker; John Turner, driver; Henry Bishop, contractor; and Dudley Bruce Wallen, merchant's clerk, all of Dresden, Ont., and Walter Mills, of Ridgetown, barrister-at-law.

The City of Cobalt Mining Company, Ltd. Head office, Cobalt, Ont. Capital, $500,000, divided into 500,000 shares of $1.00 each. Incorporators: Thomas Miles Birkett, Milton Carr, Felix Marie Devine, Arthur Sidney Goloska, Joseph Hendricks Hunter, William Drummond Hogg, Thomas William Albert Lindsay, John Cameron Stevenson and Alphonse Antoine Taillon.

The Waterloo Mining Company, Limited. Head office, Berlin, Ont. Capital, $200,000, divided into 200,000 shares of $1 each. Incorporators:—Robert Theophilus Winn, dentist, and Isaac Mickelborough Clemens, miller, both of New Hamburg, Ont.; Anson Stanley Green, photographer, and James Alexander Scellen, barrister-at-law, both of Berlin, Ont., and John Boek, of Buffalo, U.S.A.

Gordon Benson Cobalt Mining Co., Ltd. Head office, Sarnia, Ont. Capital, $300,000, divided into 300,000 shares of $1.00 each. Incorporators: William Springer, Chas. Edward Mudford, Delmar Cecil Kelly, Aaron Meyer Rose, Chas. Ashley Bailey, Daniel O'Brien, John Terney, Albert Edwin Stevenson, John Christopher Murta, all of Port Huron, Michigan, and Wm. Terney, of Roscommon, Mich.

The Ottawa Cobalt and Silver Mining Company, Ltd. Head office, Ottawa, Ont. Capital, $250,000, divided into 250,000 shares of $1.00 each. Incorporators: Robert Gorman, Frederick Weston Bindon, William James Fenton, Daniel O'Connor, William John Kidd, Alphonso Macfarlane, J. Ogle Carss, Samuel Fee, Robert Preston Robinson, Edward Theodore Van Nierop, James Wilson, and James Henry Gervan, all of Ottawa, Ont.

BRITISH COLUMBIA.

The American Boy Mining Company, head office, City of Spokane, State of Washington, U.S.A.

The Smith Creek Mine Development Company, head office, Revelstoke, B.C. Capital, $500,000, divided into 500,000 shares of $1.00 each. John Manning Scott, Revelstoke, B.C., attorney for the Company.

CATALOGUES.

The following catalogues have been received:—

Steel Sheet Piling, issued by the United States Steel Piling Company Chicago, Ill., U.S.A.

Conveying and Transmission, published by the Stephens-Adamson Manufacturing Company, Aurora, Ill.

Franklin Air Compressors, manufactured by the Chicago Pneumatic Tool Company, Fisher Building, Chicago.

Bulletin 134, Sturtevant Engineering Series, descriptive of Steel Pressure Blowers, as made by the B. F. Sturtevant Company, Hyde Park, Mass.

Circular No. 1136, issued by the Canadian Westinghouse Company, Ltd., of Hamilton, Ont., descriptive of automatic controllers for direct current motors.

Circular No. 1138, issued by the Canadian Westinghouse Company, of Hamilton, Ont., descriptive of Direct-Current Motors, manufactured by the Westinghouse Company.

The Rockwell Heating Machines for annealing, hardening, tempering, coloring, etc., by oil or gas fuel as manufactured by the Rockwell Engineering Co., 26 Cortlandt street, New York.

Catalogue No. 10, seventh edition, Huntington Mills, manufactured by Allis-Chalmers Co., Chicago, U.S.A., represented in Canada by the Allis-Chalmers-Bullock Company, Montreal.

We are in receipt of Bulletin No. 8, 4th series of the Geological Survey of Ohio, entitled Salt Deposits and the Salt Industry in Ohio, by John Adams Bownocker, D.Sc., Professor of Inorganic Geology, Ohio State University.

Receipt is acknowledged of the following pamphlets issued by the United States Geological Survey: Chas. D. Walcott, director:—

The Production of Mineral Paints in 1905, Edwin C. Eckel.

The Production of Barytes in 1905, Edwin C. Eckel.

The Production of Bismuth in 1905, C. C. Schnatterbeck.

The Production of Sand and Gravel in 1905, A. T. Coons.

The Production of Sulphur and Pyrite in 1905, Edwin C. Eckel.

The Production of Antimony in 1905, C. C. Schnatterbeck.

The Production of Lime and Sand-Lime Brick in 1905, Edwin C. Eckel.

The Production of Platinum in 1905, F. W. Horton.

The Production of Petroleum in 1905, W. T. Griswold.

The Stone Industry in 1905, Edwin C. Eckel.

The Production of Graphite in 1905, Geo. Otis Smith.

The Production of Manganese Ores in 1905, John Birkinbine.

The Production of Iron Ores in 1905, John Birkinbine.

The Manufacture of Coke in 1905, Edwin W. Parker.

Statistics of the Clay-Working Industries in the United States in 1905, by Jefferson Middleton.

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SYNOPSIS OF CANADIAN NORTH-WEST MINING REGULATIONS.

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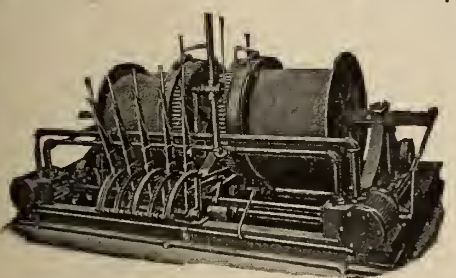

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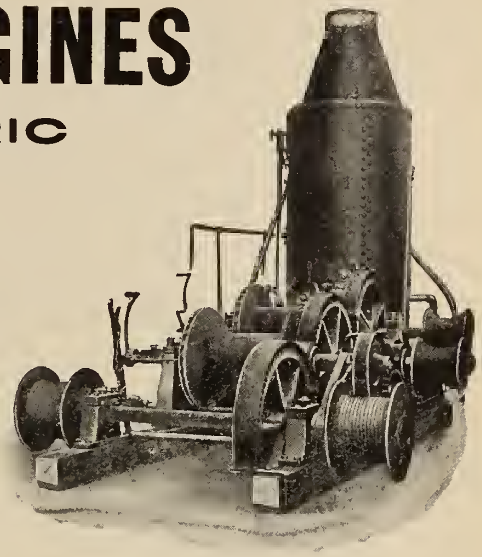

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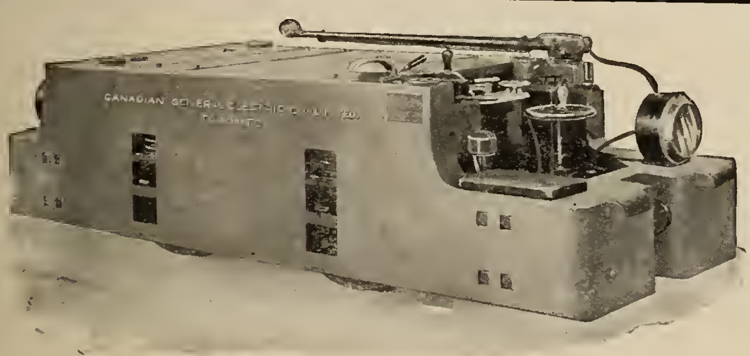

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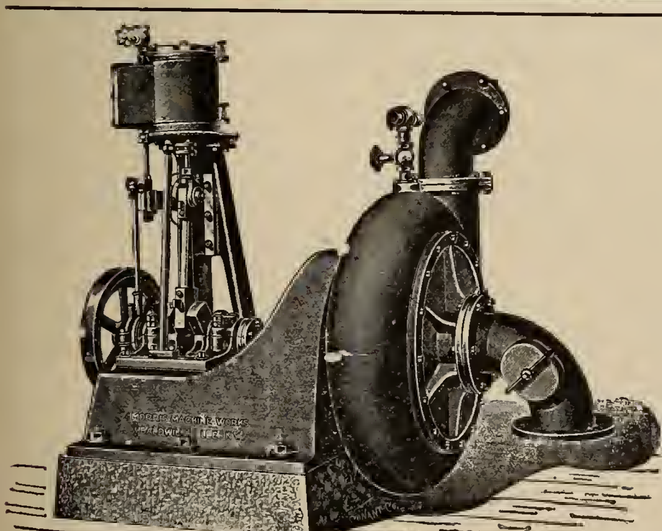

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REFERENCES:
Prof. R. Bell, Chief Geologist Dominion Geological Survey, Ottawa.
The Molsons Bank, Port Arthur, Ont
The Mayor, Port Arthur, Ont.
Prof. R. Carr-Harris, Royal Military College, Kingston, Ont.
Board of Trade, Port Arthur, Ont.
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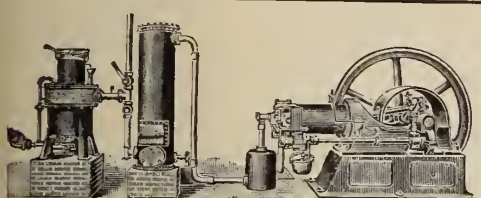

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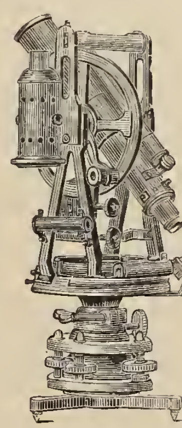

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24th YEAR OF PUBLICATION

The CANADIAN MINING REVIEW

Established 1882

THE OLDEST AND ONLY OFFICIAL MINING JOURNAL PUBLISHED IN CANADA.

Published by The Review Publishing Co., Ltd. PUBLISHED MONTHLY. 171 St. James St., MONTREAL.

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The REVIEW'S columns are always open for the discussion of questions cognate to the mining industry.

Advertising rates on application.

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Charles A. Bramble.

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H. W. Hixon, Victoria Mines, Sudbury.

BRITISH COLUMBIA:

Alfred W. Dyer, Nelson.

CONTENTS.

Copper stocks decreased 236 tons during the first fortnight of November, but the visible supply increased 489 tons. The visible supply, according to Jas. Lewis & Sons' mid-monthly report, was 13,468 tons. This is larger than it has been at any time since the first of January, 1905. The price in that time has risen for Standard from £68 12s. 6d. to £100 15s., and the best selected ingots from £72 15s. to £106, the price per unit has, therefore, increased from £0 12s. 7½d. to £0 19s.

A company with the title The Mines Publishing Company, Limited, through its general manager, J. H. Harpell, has, we understand, represented that the said Mines Publishing Company, had purchased or was about to purchase, the stock of the Review Publishing Company, Limited. Such a statement, if made, was false. The Review Publishing Company has not sold its stock, nor has it entered into any arrangement with the Mines Publishing Company, and we trust our friends will promptly inform us of any attempts to convey such impressions.

As we go to press the breach is still wide between the Dominion Iron and Steel Company and the Dominion Coal Company. It is believed, however, by those who are in a position to know most of what is going on, that the Honorable Mr. Fielding is interesting himself in bringing about an amicable arrangement between these powerful corporations. That their differences may be soon adjusted, is, we are sure, the earnest desire of all those who wish to see the mining and metallurgical industries of the Dominion enjoy the prosperity that seems within their grasp.

What is a mining engineer? This question has been agitating our esteemed contemporary the Mining and Scientific Press, of San Francisco; the editor has finally decided that, though a man may graduate from an engineering college, the passing of his examinations does not make him an engineer. Emphatically, he must do things, he must have put his training into practice. The obvious duties of a mining engineer are to superintend operations, plan the work of a mine, to choose, to erect, to supply machinery, to sample and examine properties in order to appraise them, and, finally, to make a mine out of a hole in the ground. The last qualification seems to us an almost insurmountable barrier in the case of the ordinary man. There are numberless holes in the ground, especially up Cobalt way, but the man who can turn some of them into mines, has not yet been born.

WHERE WILL IT END?

Amidst the unrivaled prosperity of the present moment far-sighted men think they see a danger ahead; a danger that will require common sense, firmness and honesty to ward off. We refer to the increasing inclination of the laboring man to strike. Our railways have already suffered heavily, and, now, the mining industry is getting its share of trouble. In such widely scattered provinces as British Columbia and Nova Scotia we find the walking delegate making trouble. Men who were well paid and well treated grew restive under his sinister influence, and in trying to hurt their employers, hurt themselves in a far greater measure. There is some satisfaction in this; yet it is poor consolation when we reflect that gigantic industries may be throttled by such ill-advised rebellion against employers.

Two classes of labor are especially prone to go out on strike: the overpaid and the underpaid. A man, who, owing to the scarcity of labor, is getting a wage that would seem fabulous in many parts of the world, grows fat and kicks—the underpaid man, on the other hand, may be almost forced to strike, if the conditions under which he exists become so hard that he can barely earn bread for himself and those dependent upon him. But of this class we have none working in Canadian mines. The big strike at Fernie is over. General Manager Lindsay's position was completely vindicated. Thomas Burke, the National Board Member, was forced to acknowledge that the strike was a mistake, so the men went back to work and for the present there is peace in the Pass. But what guarantee have we that this happy state of affairs will be allowed to last? Capital is proverbially timid, and if we once acquire the strike habit it will hold Canada back, and her progress, notwithstanding her great natural resources, must, inevitably, be slower than we have a right to expect. It is imperative that every manager of mines, smelting works, or other large and important industry, use good judgment in handling his men and do the best that in him lies to ward off trouble. Then, if the men will persist in striking, our legislators will have to consider what relief may be given by enactment. Law is the expression of the will of the people—and the will and desire of the Canadian people is that there shall be peace and goodwill between the man who plans and the man who toils.

THE NEW TARIFF.

The changes in the new tariff that affect the mining industry, have been officially given out as follows:—

Changes have been made in the mining machinery items in the free list. There are a number of articles which are now made in Canada which are transferred from the free list. The following articles, under the head of mining machinery, are dropped from the free list, and will become dutiable as "machinery" or as "manufactures of iron or steel," as the case may be:—Coal washing machinery, coke making machinery, charcoal making machinery, ore drying machinery, ore roasting machinery, ball and rock emery grinding machinery, jigs, classifiers, separators, blast furnaces, water jackets, monitors, and giants. All of these articles are now being made in Canada. We drop them from the free list. There have been added to the free list the following:—Parts of miner's safety lamps and accessories for cleaning, filling and testing such lamps; blast furnaces for the melting of copper and nickel; integral parts of all machinery specified in the item, the diameter of the tubing covered by the item has been increased from 2½ to 4 inches.

Now, here is one of the few cases where we make an exception as to the importation of articles for the use of the Government or of other Governments. The following articles and materials when imported by manufacturers of automatic gas buoys and automatic gas beacons, for use in the manufacture of such buoys and beacons for the Government of Canada or for export under regulations prescribed by the Minister of Customs, namely:

Iron or steel tubes over 16 inches in diameter; flanged and dished steel heads made from boiler plate, over five feet in diameter; hardened steel balls not less than three inches in diameter; acetylene gas lanterns and parts thereof; these things are made free of duty for this purpose. They could now be imported free by the Government, but we are abolishing the general item, while we reserve this for two reasons: It is not only for our Government, but for export. These are articles which are made for governments and for governments only. They are made by an extensive establishment in Ottawa, an establishment which we have reason to believe will grow very large indeed. It may be said that they do not get these articles free, that if it is for the export trade, they could get a drawback. But this is a business which would have to be carried on on a very large scale, and it is represented to us that if they had to pay their duties they would have such a vast amount of material in stock at the one time that they would have to deposit with the Government several hundreds of thousands of dollars, and keep it there all the time, the articles being very costly and taking a long time to produce, and the operations of the company being on a very large scale. If there was any danger of difficulties arising from this we would not make these articles free, but if these articles are to be made for our Government, or for foreign governments, and if there is proper supervision, we see no reason why they should not be allowed to import the articles free rather than have them pay the duties and then get a refund. There is every indication that this is going to be a very large industry indeed, and one that the whole country is interested in. It is claimed that on existing contracts the company will spend no less than $800,000 for labor in Canada in the next two years.

Blast furnace slag trucks, of a class or kind not made in Canada, are placed on the free list.

A NEW DEPARTURE.

The Geological Survey have lately published Volume XV of the New Series initiated by that department in 1885. Perhaps this volume, more than any of the preceding fourteen, points the moral we have long maintained, that the binding together a certain set of reports that have no relation whatever to each other, is a scheme that is almost as clumsy as it is unpractical. It has always been a rule of the Survey that the Summary and the Statistical Reports shall form part of the annual volume. This may have been an excellent rule so long as the Summary remained what its name implies—a summary. Year by year, however, the Summary Report became longer and yet longer; a humble seventy pages in 1885 expanded to nearly 500 pages in 1902, and the contained reports left nothing—or at least very little—of practical interest to be added. The same may be said of the statistical reports. This series, which was commenced in 1886, reviews, in a concise and well-arranged manner, the mineral production of the Dominion for the past year. In the first report eighty-six pages were found sufficient in which to include all the required information. With the growth of the mineral industry the report naturally expanded, and of late years has generally run to over 200 pages.

It soon became evident that, a volume of more than 1,000 pages being too bulky for every day use, very little space would be left for other matter after the needs of the Summary and the Statistical Report had been provided for. This is ridiculously apparent in Volume XV, which, although a bulky tome of over eleven hundred pages, only contains one small report (a paper on the Souris coal field) in addition to the summaries for 1902-3 and the Statistical Report.

It is, therefore, with a good deal of satisfaction that we learn that Director Low has decided after the issue of Volume XVI, now in press, to abandon the issue of any further volumes. For, apart from what we have already said, there has always been a very strong reason for objection to these volumes. They have invariably appeared, not weeks or months, but years after they were of most practical use. The Survey Report for 1902, for instance, is published in 1906, a state of affairs creditable neither to the Geological Survey nor the Printing Bureau, though to whom the blame should be apportioned it is, of course, impossible for outsiders to say.

We congratulate the Director on his decision to abandon this cumbersome and belated series, and we look forward to the prompt issue of future reports just as soon as they can be prepared by the officer on his return from the field.

FRANKLIN CAMP, B.C.

In 1900 Mr. R. W. Brock, of the Geological Survey, whose name is so well known in connection with the geology and mining industries of the Kootenay district, made an examination of the Franklin camp, B.C., situated up the north fork of the Kettle River, about forty-five miles by railway from Grand Forks. After describing the gold-bearing rocks of the district Mr. Brock gave particulars of the more promising claims, especially the Banner and the McKinley, and spoke encouragingly of the prospects and possibilities. At the time of Mr. Brock's visit the camp was considerably hampered by two difficulties—first, that of transportation, being three days from Grand Forks, and, second, that bug-bear, which is so often the reason of delay in development in mining camps, namely, the ridiculous prices put on their claims by prospectors, who seem to think that because a lode happens to contain a valuable mineral it necessarily contains it in paying quantity.

Mr. Brock has lately returned from a visit to this camp and his views on it will shortly be included in the Summary Report of the Geological Survey whose Director has, we understand, decided to bring the report out as soon as possible after the return of the field officers, instead of publishing it in June or July of the following year, when it has lost half its value. Meanwhile we learn that Mr. Brock is very well satisfied with the progress that has been made in the camp during the last five years. The McKinley, which has probably had $30,000 expended on it, and the Banner are still two of the principal mines and are under development by a company, while the Gloucester, which at the time of Mr. Brock's visit was only down fifteen feet, has been taken over under bond by the Dominion Copper Company.

In general the ores carry only a small value in gold, although the Gloucester ore is reported to carry nearly $6, a proportion sufficiently large to be treated as a by-product if there are no chemical difficulties.

Several small companies are doing a little work on the Maple Leaf and other groups, and a number of prospectors are busy on their claims.

The two above mentioned initial difficulties have disappeared or at least are disappearing. The camp can now be reached in a day from Grand Forks and a railway is being constructed from that place, which will naturally considerably reduce mining expenses.

Moreover, the prospectors have brought their ideas of prices and values down to a business basis, and have realized that the mine purchaser of to-day wants something more for his money than a hole in the ground.

Mr. Brock sums up his views of the camp in the following words: "While none of the claims are yet past the prospect stage (though the McKinley is developing satisfactorily), and none have been proved to any considerable depth, the camp possesses some of the ear-marks of a mineral-bearing district. Additional discoveries are extremely probable, and there seems to be a reasonable prospect of something in the camp developing into a mine."

A TOPOGRAPHICAL SURVEY.

We hear much and we read much of the enormous strides made by this Dominion during the past decade, yet in one very important matter progress seems to have been almost at a standstill. We refer to the fact that there is not now—and there seems very little chance of being in the near future—an accurate topographical map of this northern portion of the American continent. Maps there are in plenty of a sort, but of the sparsely inhabited or semi-explored regions, which, after all, comprise ninety-five per cent. of this Dominion, maps with any pretence to accuracy are few and far between.

It may, indeed, be said that beyond some lately made contour maps of the Rocky Mountains, the only maps worth having of the less known regions of Canada are those issued by the Geological Survey. It is not, however, the duty of that department to map the topography of the country, and the natural result is that, though the Survey's maps satisfy the miner, prospector and scientist, they are of little practical good to the lumberman and settler.

This absence of reliable topographic mapping is all the more incongruous when we remember that there is a plenitude of mapping departments that would seem to guarantee, not a dearth but an excess of such information. The Department of Agriculture issues maps, the Post Office issues maps, the Dominion Land Branch issues maps, the Astronomical Branch, the Boundary Surveys, the Department of Marine and Fisheries, the Department of Militia and Defence, the Department of Indian Affairs—all, from time to time, issue maps; and yet remains the bald result—the topography of Canada is as yet unmapped.

For many years a cry has gone up from the Survey officers—but it has often literally been a cry in the wilderness—that they have had to employ fifty per cent. of their field time in mapping the topographical features before they could attack the geological. This is manifestly unfair to the field officer and is bad business for the Dominion, for it is always bad business to pay a special salary for ordinary work. Any one with average intelligence can aspire to be a topographer; a first-class geologist can only be rightly so-called when he has had a special training, both in science and the art of observation.

Since 1883, when a committee of the House recommended that a topographical survey of Canada be undertaken, the Royal Society of Canada, the Canadian Society of Civil Engineers, the Canadian Mining Institute and many other bodies of scientific men who appreciated the need of such work have moved in the matter. What is required are maps showing accurately the surface features of the country, which would not only be of great value for depicting upon them the geology, mineral wealth, forests and other natural resources, but would also be very useful in ordinary commercial enterprises by showing accurately the distances between various places, the nature of the intervening country, the catchment or drainage basins of streams, the location and size of water-powers, the grade between points where railways, canals, drainage and irrigation works are contemplated and many other purposes. With such a map many of the preliminary surveys for railways and canals now made by the government and by private companies, often at great cost, would be unnecessary, and a saving annually of large sums would be made in these undertakings.

The present methods of producing maps are costly and not up to a sufficiently high standard, while an amount of duplication is entailed that would never be allowed in any but a government undertaking.

THE GEOLOGICAL SURVEY.

Each succeeding exploration in the northern part of Western Canada serves to extend our estimate of the area of cultivable lands in that region and to curtail correspondingly the inhospitable wastes looked upon in the past as too cold for settlement by Europeans.

Mr. William McInnes of the Geological Survey. who has just returned from a geological exploration of a tract of country lying to the north of the Lower Saskatchewan, between that river and the valley of the Upper Churchill, speaks highly of the agricultural capabilities of a large area of wooded country lying between N. lat. 54° 30′ and 56°.

This country is essentially a rolling clay-covered plateau 700 to 900 feet above the sea, the valleys of its streams and lakes lying generally but little over a hundred feet below its uplands.

The clay mantle, a hundred feet or more deep in the eastern portion and gradually thinning out westwards, is the result of sedimentation over the bottom of an ancient glacial lake that has been named Lake Agassiz, once covering all the lower parts of Manitoba, including the fertile valley of the Red River nearly to its head, but now represented only by the basins of Winnipeg, Manitoba, Winnipegosis and other smaller lakes. The waters feeding this ancient lake, passing out from the face of the glacier, were heavily charged with rock flow that, in the quiet waters of the lake, quickly settled to the bottom to form the deposits referred to.

Careful records of temperature made during the summer show that the region is by no means so cold as is commonly supposed. With the exception of one night in August, when the thermometer fell just below freezing point, there was no frost from the middle of June, when the records were begun, until the 29th of September.

Throughout the whole northern part of the area the Indians grow potatoes with good success, and to any one familiar with the Indian this means that they are grown, to say the least, without much trouble. Some of the most northerly Indian fields were visited on July 13th, when the potato vines were eleven inches high and about ready to blossom.

George Cowan, a trapper long settled in the neighborhood, was harvesting in September a large crop of potatoes of exceptional size, quite like the exhibits one sees occasionally at county fairs, and his garden contained all the common vegetables.

In latitude 54°, where the Hudson Bay Railway, now under construction, crosses the Saskatchewan River, Indian corn was quite ready for table use, with large and full ears, on September 5th, and, as there was no frost until the 29th had ample time to ripen.

The more southerly section of this district bordering the Saskatchewan and extending for about seventy miles to the northeast, is underlain by flat magnesian limestones of Silurian and Cambro-Silurian age, and, owing to the thin soil cover on the uplands, offers only limited areas along the river valleys that are adapted for cultivation. There are a few good forests of white spruce and much larger areas that would furnish good material for pulpwood. Many of the limestones are well suited for building purposes, breaking readily into blocks of very even thickness.

Belts of Huronian age, underlying the limestones and coming to the surface beyond its northern edge, are characterized by many of the rocks found in that mineral-bearing series in the east. Traces of copper were noticed in these rocks.

The larger lakes of the district are well stocked with whitefish, lake trout, doré and pike, and sturgeon occur in some of them. One of the large fishing companies, in anticipation of the advent of the railway, has already put in a plant on some of the lakes.

The region is a good one for large game, particularly for moose, which are abundant and little disturbed, as the Indians visit the interior only on their winter hunts, living almost continuously on their reserves during the summer. Work on the railway south of the Pass was being pushed forward with all the speed that the scarcity of labor would permit, and location parties, who expected to be out all winter, started from the Saskatchewan to locate through to the Churchill.

THE WESTERN COAL INDUSTRY.

If the development of the coal industry is to be taken as indicative of the prosperity and development of a region, then Western Canada is making almost unprecedented strides. Mr. T. C. Denis, of the Geological Survey, has just returned from a visit through the principal western coal fields of the mainland, and he reports that everywhere coal mining is going ahead at a tremendous rate. It is only a very few years since the only coal mines worthy of the name operating in Alberta were the Lethbridge and the Canmore mines. These have expanded into large enterprises, and many other similar ventures have since achieved success. There are now in the provinces of Alberta and Saskatchewan over twenty well established and well equipped collieries, besides countless smaller mines which are worked spasmodically to supply local wants.

Figures speak louder than words. The records kept by the Mines Section of the Geological Survey show that in 1887 the coal production of the then Northwest Territories was for that year 74,152 tons, valued at $157,577. In 1905 the figures for Alberta and Saskatchewan had attained over 1,000,000 tons, representing a value of over $2,000,000. In other words, in eighteen years the production had increased about fourteen-fold.

But even at a very greatly increased rate of production, the question of exhaustion of the fossil fuel is yet in a future exceedingly remote, for it has been calculated that the coal-bearing region of the great plain provinces, between the international boundary and the 56th parallel of latitude, has an area of over 65,000 square miles.

In this vast expanse of country all the different grades of coal are represented—from a lignite, containing 14 per cent. moisture, 36 volatile matter and 44 per cent. fixed carbon, to an anthracite with as much as 90 per cent. fixed carbon. This variety of coal allows of each industry to be suited to a nicety according to its requirements, and coals of superior quality may be found for steam-raising, blacksmithing, coke manufacture and domestic use.

One of the features of the coal industry of Alberta in 1906 has been the inauguration of new methods of mining in the Edmonton region. Heretofore the coal for the use of the district was mined by means of tunnels driven on the coal seams which outcrops on the steep and high banks of the Saskatchewan; this coal was then shipped by means of scows. But with the growth of the region these means were thought inadequate, and within the last three months three shafts have been sunk, the deepest to 200 feet, which will greatly facilitate the extraction, and the coal production is now ready to keep apace with the growth of the region expected by the most sanguine Edmontonian. The product of the mines of this district is a lignitic coal well adapted to domestic uses.

At Bankhead, near Banff, the Pacific Coal Company is mining anthracite. The preparation of this coal for the market is attended with the production of a very large proportion of coal dust. After a long series of experiments as to the best means of utilizing this dust, the coal company is at present erecting a very complete and up-to-date briquetting plant, and it is expected that within a few months an excellent fuel, new to Canada, will be placed on the market in the form of "anthracite coal dust briquettas."

On the mainland of British Columbia the coal industry has not been less active. It is true that in 1906 the only producing company besides the Vancouver Island collieries was the Crow's Nest Coal Company, but preparations were being made in the Crow's Nest field, in its northern extension and along the line of the Canadian Pacific Railway for the establishment of new and important mines.

At present the largest individual colliery of British Columbia, and of Western Canada for that matter, is the Coal Creek colliery of the Crow's Nest Coal Company, which can handle 4,000 tons of coal in a day of ten hours.

Over and above all the producing fields, there are yet in these provinces vast tracts, underlaid by incalculable quantities of coal, which are waiting the advent of the railroad to be developed and to become important producers; and Mr. Denis believes that, judging from all appearances, they will not have to wait very long.

THE COAL FIELDS OF NEW BRUNSWICK.

For nearly a century coal has been mined in New Brunswick in a desultory fashion from the somewhat thin seams which spread over a wide area. The coal basin itself contains an area of over 10,000 square miles, but of this area it is safe to say that a large proportion does not carry seams of sufficient thickness to be profitably worked by any known system of mining. At several localities, however, as at the head of Grand Lake, in the Newcastle creek basin, now known as Minto, two seams occur, one of which has a thickness of 24 inches, the other of six inches. Occasionally these seams come almost together or are separated by a thin parting of black shale, so that a thickness of 28 to 30 inches of coal can be mined. For many years the entire output of this area was shipped as run of mine, but little care being taken to separate shale or sulphur; so that the coal as shipped was dirty, and the entire output was regarded with great disfavor as a mineral fuel. Within the last four years, however, a change in mining methods has been inaugurated, and the coal after mining, is carefully screened, inspected and shipped by rail to the Intercolonial at Norton, where it is used on that railway between St. John and Moncton, and gives good satisfaction as a steam producer.

It is but fair to say that this increased value in the coal is largely due to the improved methods. Formerly the coal was dug out of the thin seam, haulage to entrance being by small cars; then shovelled into waggons carrying a ton and a-half, hauled to the landing on the lake and dumped. After lying here for a time it was loaded on wood boats by barrow, and again dumped into the vessel whence it was transhipped to St. John or Fredericton. Here it was again barrowed to wharf, shovelled into cart and hauled away. In all then, this coal from the mining to the final destination was handled six to eight times. As a consequence the coal, with the contained shale and sulphur, was badly broken up, so that the resulting fuel could scarcely be expected to give very good satisfaction as a house fuel or in any other way. At the present time a considerable proportion of the output from the mines of this district, say 10 per cent., is handled in the same crude manner. The mining by modern methods furnishes a very different fuel. As examined on the loaded and inspected cars at the pit mouth, the coal is bright and clean, no stone or sulphur was visible and the fuel was apparently as good as any from the mines of Nova Scotia.

The total output from this group of mines has now reached for the past year not far from 50,000 tons. The coal is valued at $3 per ton at Norton station, while the screenings are worth about 90 cents to $1 per ton. In all there are now 20 companies or owners mining coal in the Newcastle district. Of these, nine ship their output by rail, working all the year, while the rest work intermittently and ship by water from Newcastle landing. It is clear that though the seams worked are thin, ranging from 30 inches, which represent the two seams together, down to 18 or 20 inches, in which only the larger seam is worked, the parting in this case being so thick that the thinner seam cannot be handled, a well defined profit is made on the higher grade of coal, and the output could be largely increased if the necessary miners could be obtained. If several of these companies at Minto could be brought under one management much better results would also be obtained, and efforts in this direction are now being made. If the slack or screened coal could be coked, of which there seems no doubt provided suitable ovens were erected, a still further source of profit would be found, since there is in St. John a market for all the coke which could be manufactured. This scheme is well worth consideration by the mine owners of this district.

The only other locality where coal mining is now being carried on in the province is at Beersville, in Kent county, where a similar seam outcrops on the coal branch, with a thickness of 16 to 18 inches. Drifts are driven in from the outcrop on the bank, and the coal raised from the mouth by horse-whim to the end of the branch railway which connects with the Intercolonial at Adamsville, a distance of seven miles. The force working here is small, but it is claimed that the mining is done at a small profit, the coal selling for $3.25 at the Intercolonial Railway. The quality of this coal is very similar to that from the mines at Minto.

Some years ago several borings were made at Dunsinane, on the Intercolonial, about 60 miles north of St. John and about 38 miles from Moncton. One of these sunk to a depth of 1,300 feet evidently passed through the carboniferous formation and penetrated some hundreds of feet into grayish grits of Devonian age. In several of these holes two seams, practically the same as those of the Minto basin, were passed. The coal at the outcrop is about 18 to 20 inches thick, similar to that worked in most of mines at that place. If the two seams passed through in boring come together, as they should do from the logs, not far from Dunsinane and form a seam of 30 inches at no great depth, it should be possible from its proximity to the Intercolonial to mine and deliver coal to the main line at a reasonable profit also.

Of course, in mining these thin seams it will be impossible to erect expensive plants. What mining is done must be carried on as economically as possible, with a plant for hoisting which, while efficient for the purpose intended, must not involve the outlay of much capital. This seems to have been done at King's mine in Minto, which is the only one using a steam hoist. It will also be evident that it is impossible to compete with the large mines of Nova Scotia for foreign trade, but, if economically managed, there does not appear to be any reason why a large amount of coal, possibly sufficient to supply the provincial demands, should not be raised, while if the improved methods recently inaugurated at Minto as regards mining and screening are made general, there should be no farther complaints as regards the quality of the general output.

The provincial government now own several drills which should be useful in testing the actual value of the coal basin. Some years ago a scheme for this purpose was suggested by the officers of the Geological Survey, which, if carried out, would long since have determined this question. These holes should be located on areas carefully selected, where the rock conditions are most favorable. Logs and cores should be carefully preserved as a guide in other locations, and in this way probably a large amount of unnecessary expenditure would be avoided, and satisfactory results would be obtained.

THE PRESENT STATE OF METALLURGY OF PURELY SILVER ORES.*

By James Wilding, E.M., Parral, Chihuahua, Mexico.

The object of these remarks is to point out that a certain branch of metallurgy, which ought to well repay attention, has been very much neglected of late years.

For a long time there has been, apart from smelting metallurgy, no marked advance in the treatment of purely silver ores such as has taken place in that of gold ores, due to the introduction of the cyanide process and the continuous and close study that has been given to it. We are still without a method of treatment that can at all be compared in metallurgical results with that of smelting ores in conjunction with those of silver or gold.

Unfortunately in many mining camps it is only possible to procure suitable fuel and the different classes of ores or fluxes, necessary to make up a good smelting mixture, at such cost as precludes the employment of smelting. This has led to the centralization of smelting operations in localities well provided with railway facilities, in plants of great capacity, equipped at great cost with all the necessary mechanical labor-saving appliances. The large amount of capital involved in the establishment of these plants, has led to the employment of the highest technical skill available, which has well repaid its employment by the results achieved in the reduction of operating costs and the better recovery of the values in the ores, enabling the central plants to compete with local establishments to an extent not anticipated in former years.

The very perfecting of smelting metallurgy has, however, caused a certain apathy with regard to the possibilities of local treatment. The miner has, of late, paid attention only to such ore as can be profitably shipped, ignoring the often large bodies of ore which neither can be shipped nor treated by any of the older processes at a profit. The metallurgist has received but little encouragement to undertake investigation, and we have remained in the local treatment field almost where we were twenty years ago.

It may be considered in place to here review shortly the processes at present in use to extract the silver from ores at the place of their production.

Of these processes, the amalgamation of raw ore in pans has almost gone out of use, owing to the exhaustion of suitably-oxidized ores.

Chloridizing of the ore, followed by pan amalgamation, has the disadvantages of high losses and, in most localities, of high costs. The losses are partly due to imperfect chlorination and partly to the volatization of silver chloride in the roasting, which is probably never less than seven per cent. of the silver content of the ore, and may exceed thirty per cent. with certain ores, if the roasting temperature be not very accurately controlled.

Chloridizing of the ore followed by leaching with hyposulphite of soda has the same disadvantage of high loss as the above, with the additional one that the end product, "sulphides," has to be further treated. This is usually compensated, however, by the lower cost of leaching.

The Russell process, introduced in 1885, has generally failed to give satisfactory results with raw ores. It can only be regarded as an aid to the older "hypo" process in cases of imperfect chlorination, or in which the chlorination "goes back" during the preliminary washing with water.

"Patio" amalgamation still renders good service in a few places in Mexico. In Pachuca, where it was invented and has attained its highest development, it is usually preceded, and often also followed, by concentrating out the sulphides and a large part of the small amount of gold contained in the ore. An extraction of as much as ninety per cent. of the values is claimed on ore containing 1,500 grams of silver per metric ton, though, of course, the proportion extracted from ore of half this grade is much

* A paper read at the Eighth Annual Session of the American Mining Congress.

less. The recent improvements noted are the finer grinding of the ore, and the introduction of mechanical devices for turning over the ore in the "torta" in the place of the time-honored use of animals.

Potassium cyanide has recently been used as a solvent for silver, and in cases in which a sufficient proportion of the silver is associated with sulphides removable by concentration fair metallurgical results have been attained, even though the proportion of the silver content of the concentration tailings extracted by the cyanide has not exceeded fifty to sixty-five per cent. The cost of treatment is not high, and we look for a further spread of this method for such ores.

It might be supposed from our friend Mr. Malcolmson's valuable paper that it is no longer necessary to consider the advisability of local treatment, but this, of course, was not the intention of the author, as there must always be a limiting grade for every locality, under which it will be impossible to ship at a profit. This will vary with the degree of superiority of the smelting process over that locally used, the amount of profit demanded by the smelter, the class of ore, the distance of the mine from the central plant. This limit is reached in many places in Mexico situated on a railway where the ores are silicious with 1,000 to 1,200 grams of silver per metric ton. Ore of this grade can usually be dealt with profitably in such camps by one of the older processes, but ore of a value of $10, United States currency, per metric ton, which exists so often in great quantities cannot be made profitable, although gold ores of this grade under similar conditions of mining are nearly always a source of profit throughout the United States and Mexico.

The intention of these remarks is then to impress on the mine owner that, although he may not be able to deal with his low-grade ore by any method employed up to the present, the resources of metallurgical knowledge are not necessarily exhausted, but that it may often be to his ultimate profit to devote money to the prosecution of systematic research. But for the old Cassel Company's experimental plant in Glasgow we might have waited years more for the introduction and improvement of the modern cyanide process for the treatment of gold ores.

BEYOND THE CLEARINGS.

By John McKay.

The labors and explorations of the parties that passed the summer in the Chibougamau region show that this district is, inevitably, destined to a great future. Far away as it is—one hundred and sixty miles by the new winter road from Lake Doré—the country is so flat, such an easy country for a railroad to be built through, that there is no doubt whatsoever, that, within a very few years, the Lake St. John Road, now controlled by the Canadian Northern, will haul passengers and freight between Quebec city and the mining town, that is destined to spring up under the shadow of Juggler's Mountain.

The Chibougamau Gold and Asbestos Mining Company, Ltd., possesses a strong quartz vein carrying gold, upon Portage Island, and, also some asbestos claims on Asbestos Island. The Portage Island vein is from 40 to 80 feet wide, and it has been traced for 1,000 feet, while it is believed that it extends to a greater length, as here and there, along what should be the strike of the same vein, have been found out-croppings that seem to be identical with the vein that has been opened. We have stripped the vein for some distance and have sunk on it for 30 feet, and to say that we are satisfied with the showing, is certainly not to exaggerate matters.

The asbestos fibre that we have obtained from Asbestos Island is of the very best quality. Over half the island the asbestos is found in veins of long fibre; over the other half, it is disseminated in veinlets, that must be treated by crushing. The amount of asbestos in sight is very large.

The finds made in this region are: asbestos, gold, copper, nickel, iron, both hematite and magnetite, silver, cobalt, molybdenum. The gangue is, as a rule, full of white iron pyrites, which in Northern Quebec and Ontario usually accompany more valuable minerals. No iron ore has been shipped on account of the difficulty of transportation, but a considerable amount has accumulated on the dumps of the different claims. This summer 200 men were at work in the district, and the results obtained were so encouraging that it is absolutely certain next summer will find the population very considerably increased.

Now, a few words as to the country and climate: The most southernly portion of the road between Lake St. John and Chibougamau is through bush. The climate is dry. Beyond this the road runs through a flat country, and there is good timber in sight, for 100 miles. The spruce forest contains a fair proportion of merchantable logs, and I have seen trees that measured seven feet in circumference at the butt. Last winter we occupied nearly two months in going from Lake St. John, and in the summer canoes, fairly loaded and with good weather, go from point to point in about 15 or 16 days; but we anticipate that farmers' sleds laden with some 800 lbs., will be able to go there this winter in 6 days. The lowest rates on freight have been $8.30 a hundred, but we hope to get this rate reduced to $5.00 a hundred before the spring.

The snowfall at Chibougamau is just about the same as at Quebec city, perhaps less. Winter begins in earnest by the middle of November and the spring is late, for, though the snow has largely disappeared by mid-May, Chibougamau Lake is,

To Chibougamau: Hat Rapids, Chamouchouan.

Serpentine carrying Asbestos, on "J. F." Claim, Chibougamau.

usually, clear of ice by this time. Such a long winter makes the prospecting season short, yet it will, in many respects, be an advantage when we get down to actual mining and shipping.

Another promising district lies to the westward of Chibougamau. At the Obatogaman Forks a canoe route runs off to a lake district, in which some rich silver and cobalt ore has been found during the present summer. This district is said to be about half way between Father Lake and Chibougamau. The ore brought out is similar in character to that found at Cobalt, and some of it has assayed as high as $2,800 to the ton.

Mr. John E. Hardman visited this district in the spring of 1905, and wrote very favorably of it, both as regards asbestos and gold. He concluded that, although the distribution of gold in the largest veins so far discovered is not uniform, that there are enrichments, which opinion has been justified during the present season. Mr. A. P. Low, now director of the Geological Survey of the Dominion, studied the geology of this district, which he had already passed through on his numerous journeys toward the Labrador. He found that more than three-fourths of the surface is composed of igneous rock, the remaining quarter being of sedimentary origin. The flat-lying limestones and cherty, dolomites of Mistassini appear to correspond to the upper Huronian as found about Lake Superior, but, owing to these ancient formations being without fossils, it is not possible to state this definitely. Conglomerate and fine, green arkose rocks are associated with diabase around Wakoniche Lake, and parts of the shore of Chibougamau, and along the Chibougamau River. The boulders of this conglomerate, which are large, are made up mostly of granites, diabase and dark green schists. The boulders are cemented by a dark green basic rock, almost similar to that forming the boulders of the conglomerate. This has often been changed, either wholly or in part, to chlorite or sericite. Mr. Low concluded from the presence of those minerals that the cementing material was of igneous origin, and, thought it probable that showers of ashes or an outburst of diabase covered the loose materials of the conglomerate and arkose in the shallow waters along the shores of an ancient sea.

In Wakoniche Lake isolated masses of conglomerate, together with individual boulders are found at different levels in the green basic rock, making it appear that the latter was originally a sheet of trap in which the conglomerate had floated.

The point of these conclusions is that these rocks have every appearance of being similar to those in the region west of Temiskaming, where the Cobalt silver minerals have been found in such remarkable profusion. Here, also, they are found to rest unconformably upon rocks thought to be equivalent to the Keewatin; in which case the overlying conglomerates are probably Lower Huronian. The economic minerals discovered, so far, seem to be confined to the diabase, or to its altered products, the green schists and surpentine, together with its associate conglomerate and arkose, all probably of Lower Huronian age.

The mining laws of the Province of Quebec are generous to prospectors, much more so than those of the adjoining Province of Ontario. A prospecting license may be secured on unsurveyed lands for $5.00 a square mile, and such licenses convey the right to lease, or purchase, the mines that may be on the land. These licenses are valid for three months, and are renewable at the discretion of the Minister of Mines. Should a mine be discovered a yearly mining lease is issued for a fee of $5.00, and an annual rental of $1.00 per acre. Not exceeding 200 acres may be granted to one person. Mining lands may be sold outright at prices from $2.00 to $10.00 an acre, in lots of 100 acres only.

COBALT MINES.*

W. J. Blair, B.A. Sc.

A year ago, little could have been written or said of the mines at Cobalt. To a few men on the ground there came but a faint glimmer of the richness of the deposits. The general public had not even heard of Cobalt, and those who had heard disbelieved the reports.

The town of Cobalt is situated in the Township of Coleman, about five miles from Lake Temiscaming. It is on the new Government railway, The Temiscaming and Northern Ontario, one hundred and three miles from North Bay and nearly straight north from Toronto, three hundred and thirty miles. These rare deposits of valuable mineral lay from decade to decade within a very short distance of this large lake, so well known to the earliest voyageurs and frontier missionaries. They are within four miles of a waggon road used for a quarter of a century by the Hudson's Bay Company, between the Montreal River and Lake Temiscaming. It is twenty years since the meridian which forms the east boundary of the township of Coleman was run by O. L. S. Niven, and nearly as long since C. D. Bowman, O.L.S., sub-divided the township of Bucke, which adjoins Coleman on the north. Both these surveys were within a mile of Cobalt. For many years lumbering operations were carried on right on top of these deposits. In fact camps were built within a stone's throw of a spot where over $1,000 worth of nuggets of native silver were picked off the surface. But it was left until July, 1903, for the first real discovery of mineral in the Cobalt district to be made.

It was made by two men connected with the con-

* Transactions of the Engineering Society of the School of Practical Science, Toronto.

struction of the Temiscaming Railway, the spot afterwards becoming "The McKinley-Darragh Mine," after the discoverers. This claim was not surveyed nor recorded at the time. Other discoveries made during the same year were the La Rose vein, the Little Silver vein, and the large vein on Cobalt Hill. No development work was attempted during 1903. An examination of the deposits and the immediate vicinity was, however, made under the direction of the Bureau of Mines, and this examination showed that they were extremely rich. As a consequence a careful geological survey of the district was begun in the spring of 1904, and instructions issued for the survey of Coleman Township.

With the opening of spring, a half dozen or so prospectors were attracted to the locality and two important discoveries were made in the month of May. These are on Mining Location J. B. 6, and J. B. 7, and are what are now known as the Trethewey mine. No other discoveries are noted until July of the same year, when we have those in the immediate locality of Cross Lake. A few weeks later the first discoveries were made in what is now known as the Kerr and Giroux Lake belt. This brings us to October, 1904.

Up to this time, no development had been done except on those discoveries mentioned as having been made in 1903, and on the vein on J. B. 7. The steel on the Temiscaming Railway did not reach Cobalt until late in October, and it was some time after this before the first car of ore was sent to the sampler. The winter of 1904-05 saw things progress quietly at Cobalt. On the properties, when development was started, work was carried on steadily, and occasional shipments made. With the spring of 1905, however, things put on a new appearance. The mining world had heard a little of Cobalt, and outsiders began to come in. Prospecting began in earnest and new properties were opened. Developed properties began to prepare for more extensive operations. The town of Cobalt began to grow. The obstacles which nature had put in the way were met and overcome. It might be said that up to this time, the discoveries made were accidental; at any rate all had been made on the bare exposed rock. Systematic work, trenching and clearing away moss, etc., was begun and throughout the known mineral area discoveries of proven value are now numerous.

At present the following are shipping mines. For their relative location a map of the locality may be consulted: The Buffalo mines, (Dennison), the O'Brien mines, the Earle mines, the New Ontario (Trethewey), the Savage mines, the Temiscaming and Hudson Bay, the McKinley and Darragh, the Violet mine, McLeod and Glendinning, the Watts, the Victoria, the University, the Silver Leaf, the White-Silver, the Kerr Lake Mining Co. (Jacobs), the Drummond Mining Co., the LaRose, the McLeod-Lawson.

Besides these, there are some five or six other properties which are in early stages of development, but which can hardly yet be considered shippers. As to the value and quantity of the output, the writer is not in a position to state with any exactness. It would not be extravagant to place the value at from $2,500,000 to $3,000,000, and the average value per ton at $800 to $1,000. This would give in the neighborhood of 3,500 tons, or at 20 tons to the car load, 175 car loads.

It is not the purpose of this paper to enter into the geology of the district. A complete description of this is given in the recently published report of the Bureau of Mines, Part II. The ore practically occurs in small veins of white or pink calcite in a slaty conglomerate rock of the Huronian series. A few veins are, however, found in the adjoining diabase. The metals occurring in economic quantities in these ores are arsenic, cobalt, nickel and silver. Other metals which have been found associated with these in the same veins are bismuth, copper, iron, lead, zinc and gold. The ore bodies are so variable in their composition that it is difficult to give even approximately the percentages of the metal. However, taking averages off car lots, we may quote the following: Silver, 2 per cent. to 12 per cent.; cobalt, 3 per cent. to 15 per cent.; nickel, 3 per cent. to 15 per cent.; arsenic, 30 per cent. to 60 per cent.

Those who are familiar with the history of the Cobalt camp and what has been accomplished there, have no fear of its future. However cautious the experiences of other camps in Northern Ontario would teach us to be, there can be absolutely no doubt that Cobalt is a reality. It has already been proven so. The greatest depth that has been reached by any shaft is at the LaRose mine, where they have gone to a depth of 185* feet. This alone, so far as this property is concerned, proves its value to be in the millions, while the diamond drill has shown that 185 feet is far above the known depth of mineral. There are several other shafts down to a depth of 100 feet, and show no sign whatever of giving out.

Up to the present, practically all the ore has gone to New York City and to Newark, N.J. It is shipped in sacks containing from 75 to 150 pounds of ore. This unique ore presents very many difficulties to the smelter. The peculiar combination of cobalt and nickel causes the greatest trouble, and this is augmented by the presence of arsenic. Owing to this fact, up to the present, the producers have not been able to realize the full amount of silver values. They have been able to realize very little on the cobalt and nickel, and nothing at all on the arsenic and other metals above mentioned. The greatest problem that confronts the mines at present, then, is

* This shaft is now said to be down 300 feet.

the economical smelting and refining of these products.

The question is often asked, "What is the likelihood of the mineral area widening so as to extend for several miles on all sides of Cobalt?" Like many other questions asked about these deposits, the answer must be one which leaves the enquirer without any added information. The conglomerate rock wherein the mineral most frequently occurs at Cobalt is, roughly speaking, the country rock for fifty miles on all sides. This will seem encouraging to the prospector who is just starting in, and yet perhaps is not much of a comfort to the many who spent the summer of 1905 with shovel and pick and hammer and drill on the rocks of Temiscaming. Cobalt bloom, and in most cases the ore cobalt (smaltite), have been found in the following places, viz.: west side of Bay Lake (near Trout Lake); on the east side of the Montreal River, near Bay Lake; in Lot 19, Concession IV., Coleman Township, close to Bay Lake; in very many places in Bucke Township; in the Townships of Firstbrook, Dymond, Hudson, and Lorrain, in several places in Lots 9 and 10, Concession VI., Ingram, and in the unsurveyed territory north of the Townships of Ingram and Pense. It is also reported that the same indications have been found near Lake Kenogami, north of the Township of Burt. From this it would appear that the field is likely to be very large. However, nothing of value has been proved in the case of these last mentioned discoveries, and none of them appear to run above a few ounces per ton in silver values. These facts, however, ought rather to encourage rather than to discourage, when we remember that the first discovery of mineral on Lake Temiscaming was made over a century ago, and is probably what is now known as Wright's Mine on the east shore.

THE ECONOMICAL PRODUCTION OF COMPRESSED AIR.

"It is the rule, rather than the exception, to find a compressed air plant fitted with the best of pneumatic tools and appliances but the most wasteful apparatus for compression." This statement, made upon the authority of Allis-Chalmers Company, of Milwaukee,* is sufficiently startling to command attention, as is also the fact that for such a condition inventors and designers of apparatus utilizing compressed air are to a certain extent held resposible; "for while they have been actively engaged in improving efficiencies and widening the field of application, they have apparently considered compressed air only as delivered to their machines, without giving much thought to cost of production and delivery." As the use of compressed air is extended to each individual plant, and increased compressing capacity is required, this indifference should give place to a wideawake consideration of the economies possible in the cost of production.

To illustrate its meaning the company mentioned enters into a very full explanation, from which we quote the following:

The work performed by an air compressor is, broadly speaking, that of increasing pressure of the air (or other gas) from a lower to a higher stage by reducing its volume or compressing it into smaller space. Usually in air compressor practice the lower or initial pressure is the "atmospheric pressure" at point of location of compressor, while the higher or terminal pressure is fixed by the requirements of the particular case, and may be anywhere from 10 to 30 lbs. (gauge pressure) per square inch, as in blowing engine practice, up to 80 to 100 lbs. per square inch for rock drills, pneumatic tools, etc., and up to 1,500 to 2,000 lbs. per square inch, or even higher, for special purposes. Compressors which work against pressures under 30 lbs. gauge are usually called blowing engines. Atmospheric pressure (or zero gauge pressure) equals 14.7 lbs. absolute pressure per square inch at sea level (equivalent to 30 in. barometer) and becomes less as the altitude above sea level increases, the decrease being approximately one-half pound, or one inch in mercury column, for each 1,000 feet increase in altitude. As the work of compression depends upon the initial and terminal absolute pressures (absolute pressure being equivalent to gauge pressure plus atmospheric pressure) the altitude at which the compressor is to work is of great importance and should always be taken into consideration.

When air is compressed into a smaller volume, if the temperature remains constant, the pressure increases directly in proportion to the decrease in volume; that is, if the volume is one-half, the pressure will be doubled; if one-third the pressure will be trebled, and so on for any decrease in volume. There is, however, another and most important factor in the problem which must be considered in all cases except the lowest terminal pressures, viz.: the increase in temperature and consequent increase in volume due to the heat developed during compression. When air is compressed, the work done during compression is converted into heat, which must be taken up by the air compressed, the result being to very materially raise its temperature and increase its volume, thus adding largely to the work required to be done. Without going into a theoretical discussion of this factor in the problem, a brief statement of facts will show its great importance.

If air at atmospheric pressure and 60° Fah. could be compressed to 100 lbs. gauge pressure and all the heat due to the work of compression taken away as fast as generated, so that the temperature dur-

* Represented in Canada by the Allis-Chalmers-Bullock Co., Ltd., of Montreal.

ing compression would remain constant, the mean effective pressure during one stroke of the air piston would be 30.2 lbs. If, on the other extreme, none of the heat due to the work of compression is taken away, the mean effective pressure during the stroke will be 41.6 lbs., and the terminal temperature will reach 485° Fah. As the power required for compression is directly proportional to the mean effective pressure, it will be seen that the additional power required in the latter case is 37½ per cent. of that in the former. In practice neither extreme can be reached, for it is impossible to completely cool the air during compression, and, on the other hand, some of the heat of compression will be radiated; but the lower extreme is the ideal, and the nearer it can be approached the more economical the compressor will do its work.

Various plans for taking away the heat during compression, such as injecting a spray of water into the cylinder, circulating cooling water through the piston and around the heads and cylinder barrel, etc., have been tried. The use of the cooling spray, or so called "wet compression," has long since been abandoned, as has also the plan of circulating water through the piston, for the disadvantages more than offset the possible gains. Cylinder heads and barrels are still water-jacketed, not so much on account of the heat that can be taken from air as to keep the cylinder cool enough for proper lubrication. The most effective means for taking away the heat of compression and reducing the amount of power required consists in dividing the compression into two or more stages, depending upon the terminal pressure desired, and cooling the air as much as possible between stages by means of suitable cooling apparatus; the water-jacketing of the cylinders and heads being retained for the reason above stated. Where the work of compression is done in two or more tainment. In the first place, even with an unobstructed inlet passage air will not flow into the cylinder without some difference in pressure to force it in, and when, as in many compressors, the inlet valves are of the spring weighted poppet type, this difference as to its effect upon capacity and efficiency becomes a serious matter. Then, again, the entering air comes in contact with the cylinder walls and clearance surfaces which have become highly heated from the compression in the preceding stroke, and is thereby heated to a higher temperature than before entering. This not only reduces the volume of free air at the outside temperature which can be handled, but also raises the terminal cylinders, it is customary to so fix the ratio of cylinder volumes as to divide the work equally between the cylinders. By using two stage compression and cooling the air between the stages to its initial temperature (60° Fah.), without considering the cooling by water-jacketing, it is possible to reduce the mean effective pressure to 35.5 lbs., as compared to 41.6 lbs. in the case above given, which is equivalent to a saving of 15 per cent. At the same time the terminal temperature will be only 245° Fah. instead of 485° Fah. In practice the saving may be a little less and the terminal temperature somewhat higher, as the initial temperature in both cylinders will usually be higher than 60° Fah., but, after making all allowances, the figures afford an indisputable argument in favor of two stage compression for pressures commonly used.

Another important factor in compressor design is the clearance in the compressor cylinders. It is not possible to run a compressor without some space between the piston and the cylinder head at the end of the stroke, and in addition there is the volume in the inlet and discharge passages between the valves and cylinder space. It is the aim of all good designers to make this clearance space as small, in proportion to the volume swept through by the piston, as possible; for at the end of the stroke the clearance space is filled with air at the terminal pressure which must expand back to the initial pressure before the inlet valve is opened. This is particularly important in single stage compression, as at discharge pressures ordinarily used the expanding of the compressed air in the clearance space back into the cylinder seriously affects the volumetric efficiency of the compressor. If the volume swept through by the piston in one stroke is one thousand cubic inches and the clearance volume is twenty cubic inches, the compressor has two per cent. clearance. In this case if the discharge pressure is 75 lbs. gauge (89.7 lbs. absolute) and the initial pressure is atmospheric at sea level (14.7 lbs.) the air in the clearance space will expand to six times the clearance volume, or to 120 cubic inches, and, as the clearance volume is only 20 inches, the remaining 100 cubic inches must be in the cylinder; that is, the piston must travel back ten per cent of the return stroke before opening the inlet valve, and the actual room for the admission of free air is only 1000-100=900 cubic inches; or, as commonly stated, the volumetric efficiency of the compressor is only 90 per cent.

It is the common practice of compressor builders to call the free air capacity of their machines the volume theoretically swept through by the piston, without making any deductions; that is, if the area of the piston is two square feet and it travels 500 feet per minute, the capacity is called 1,000 cubic feet per minute. It will readily be seen that in the case above cited, if the clearance is two per cent. the actual capacity is only 900 cubic feet per minute, and if 1,000 cubic feet is wanted the compressor must be speeded up to 555 feet per minute. It may be stated in this connection that in the majority of the compressors in daily use the clearance exceeds two per cent., and the volumetric efficiency is less than ninety per cent. The clearance also adversely affects the efficiency of the machine, for, in addition to the loss from greater friction on account of the increased speed required for a given actual capacity, the air in the clearance space in expanding to the initial pressure never gives back quite as much power as was used in compressing it. Inasmuch as with any given diameter and travel of piston the clearance space is practically a constant quantity, the longer the stroke the less the percentage of clearance. If a cylinder of 30 in. diameter by 60 in. stroke has one and one-half per cent. of clearance and the stroke is shortened one-half, i.e., to 30 in., the percentage of clearance will be doubled, or three per cent. It is therefore better to get the required capacity by using a small diameter and long stroke rather than larger diameter and shorter stroke, even if the advantages of greater reliability in operation, durability and lower cost of maintenance and repair arising from slower rotative speed for a given piston travel are not considered. As a matter of fact, advantages, together with the increased efficiencies, will more than offset the disadvantages arising from higher first cost, increased floor space, and greater expense of installation.

The loss of volumetric efficiency due to clearance is less in two-stage than in single stage compressors, because for any given capacity the first or low pressure cylinder of the two stage machine is practically of the same size and has the same percentage of clearance, while the terminal pressure is much lower; consequently the expansion back into the cylinder volume is much less and the volumetric efficiency higher. This fact affords another strong argument for the use of two-stage compressors.

Another factor affecting compressor capacities and efficiencies merits careful consideration. It is the common practice to not only rate the capacity at the full volume swept through by the piston, but to assume that the cylinder is filled at the beginning of the stroke with air at full atmospheric pressure and at no higher temperature than the outside source of supply. A moment's consideration will show that such ideal conditions are impossible of attemperature of compression. The latter effect may become cumulative, for the higher the terminal temperature the more the surfaces become heated, and the higher the entering air is heated, resulting in still higher terminal temperature. In cases where the water-jacketing is inefficient or the water circulation becomes interrupted, the cumulative effect may result in heating the compressor cylinder to a dangerous degree. We recall one instance of a small high speed single-stage compressor which, while working in a rather dark room against eighty pounds discharge pressure, became so heated as to show a dull red. It is essential to good economy that the air be brought to the compressor and gotten into the cylinder with as little heating as possible. To accomplish this the inlet ports should be short and direct and the air admitted in a solid stream and not cut up into thin sheets. Admitting air through a hollow piston and piston rod, or straining it through metal guards which are frequently used to prevent poppet inlet valves from getting into the cylinder in case of breakage of valve stems, manifestly results in undue heating and consequent loss. In this matter of initial heating of the air, the two-stage compressor has a marked advantage over the single-stage, because the terminal temperatures are much lower, consequently the cylinder walls and clearance surfaces do not become so highly heated and the transfer of heat to the incoming air is much slower.

What has been said above applies to compressors of every type, whether for air or other gases, and no matter how driven.

Mean Effective Pressure and Indicated Horse Power

Required to compress a cubic foot of free air (Adiabatically) from atmospheric pressure (14.7 lbs.) to various gauge pressures. Initial temperature of air in each cylinder taken as 60° Fh. Jacket cooling not considered.

			Single Compression.		Two-stage Compression.		
Gauge pressure pounds.	Absolute pressure pounds.	Ratio of compression.	Mean effective pressure, friction included.	Indicated H.P. per cubic ft., free air friction included.	M.I.P. per sq in., reduced to low pressure, air cylinder friction included.	Indicated H.P. per cubic ft., free air friction included.	Per cent. of power saved by two stage over single compression (theoretical).
5	19.7	1.34	5.12	.022	.....	....	....
10	24.7	1.68	9.44	.041	.....	....	....
15	29.7	2.02	13.17	.057	.....	....	....
20	34.7	2.36	16.44	.071	.....	....	....
25	39.7	2.70	19.47	.085	.....	....	....
30	44.7	3.04	22.21	.096	.....	....	....
35	49.7	3.38	24.72	.103	.....	....	....
40	54.7	3.72	27.05	.118	.....	....	....
45	59.7	4.06	29.21	.127	.....	....	....
50	64.7	4.40	31.31	.136	.....	....	....
55	69.7	4.74	33.23	.145	.....	....	....
60	74.7	5.08	35.10	.153	.....	....	....
65	79.7	5.42	36.91	.161	.....	....	....
70	84.7	5.76	38.59	.168	33.71	.147	12.7
75	89.7	6.10	40.25	.175	34.99	.153	13.0
80	94.7	6.44	41.80	.182	36.15	.158	13.5
85	99.7	6.78	43.27	.189	37.32	.163	13.8
90	104.7	7.12	44.71	.195	38.36	.167	14.2
95	109.7	7.46	46.12	.201	39.41	.172	14.5
100	114.7	7.80	47.46	.207	40.48	.176	14.7
110	124.7	8.48	50.09	.218	42.34	.185	15.4
120	134.7	9.16	52.53	.229	44.20	.193	15.9
130	144.7	9.84	54.87	.239	45.83	.200	16.5
140	154.7	10.52	57.08	.249	47.46	.207	16.9
150	164.7	11.20	59.18	.258	48.99	.214	17.2
160	174.7	11.88	.....	....	50.39	.219	....
170	184.7	12.56	.....	....	51.66	.225	....
180	194.7	13.24	.....	....	52.95	.231	....
190	204.7	13.92	.....	....	54.22	.236	....
200	214.7	14.60	.....	....	55.39	.241	....
250	264.7	18.00	.....	....	60.76	.264	....
300	314.7	21.40	.....	....	65.20	.283	....
350	364.7	24.81	.....	....	69.16	.301	....
400	414.7	28.21	.....	....	72.65	.317	....
450	464.7	31.61	.....	....	75.81	.329	....
500	514.7	35.01	.....	....	78.72	.342	....
550	564.7	38.41	.....	....	81.30	.354	....
600	614.7	41.81	.....	....	83.75	.364	....

Table Showing the Relative Volumes of Compressed Air at Various Pressures.

Gauge Pressure Pounds.	Volume of free air corresponding to one cubic ft. of air at given pressure.	Corresponding volume of one cubic ft. of free air at given press.
0	1.00	1.00
1	1.068	.9356
2	1.136	.8802
3	1.204	.8305
4	1.273	.7861
5	1.34	.7462
10	1.68	.5951
15	2.02	.4949
20	2.36	.4236
25	2.7	.3703
30	3.04	.3288
35	3.38	.2957
40	3.72	.2687
45	4.06	.2462
50	4.40	.2272
55	4.74	.2109
60	5.08	.1967
65	5.42	.1844
70	5.762	.1735
75	6.102	.1638
80	6.442	.1552
85	6.782	.1474
90	7.122	.1404
95	7.462	.1340
100	7.802	.1281
110	8.483	.1178
120	9.170	.1090
130	9.843	.1016
140	10.52	.0950
150	11.20	.0892
160	11.88	.0841
170	12.56	.0796
180	13.24	.0755
190	13.92	.0712
200	14.60	.0684

Relative Volumetric Efficiencies at Various Altitudes Above Sea Level.

Altitude above sea level, in ft.	Barometer, in inches.	Percentage of volumetric efficiency.	Decreased power required, 80 lbs., single stg %
0	30.00	100	.000
500	29.45	93.5	.015
1000	28,90	97	.025
1500	28.35	95.5	.04
2000	27.78	94	.05
3000	26.75	91	.07
4000	25.75	88	.09
5000	24.70	85	.11
6000	23.86	82	.13
7000	22.97	79	.14
8000	22 10	76	.16
9000	21.30	73	.17
10000	20 60	70	.18
11000	19.75	68	.20
12000	19.00	65	.21
13000	18.30	62	.23
14000	17.60	59	.24
15000	16.95	57	.25

THE LIME-ROASTING OF GALENA.*

(By W. R. Ingalls.)

During the last two years, and especially during the last six months, a number of important articles upon the new methods for the desulphurization of galena have been published in the technical periodicals, particularly in the *Engineering and Mining Journal* and in *Metallurgie*. I proposed for these methods the type-name of "lime-roasting" of galena as a convenient metallurgical classification,[1] and this term has found some acceptance. The articles referred to have shown the great practical importance of these new processes, and the general recognition of their metallurgical and commercial value which has already been accorded to them. It is my present purpose to review broadly the changes developed by them in the metallurgy of lead, in which connection it is necessary to refer briefly to the previous state of the art.

The elimination of the sulphur-content of galena has been always the most troublesome part of the smelting-process, being both costly in the operation and wasteful of silver and lead. Previous to the introduction of the Huntington-Heberlein process at Pertusola, Italy, it was effected by a variety of methods. In the treatment of non-argentiferous galena concentrate, the smelting was done by the roast-reduction method (roasting in reverberatory furnace and smelting in blast-furnace); the roast-reaction method, applied in reverberatory furnaces; and the roast-reaction method, applied in Scotch hearths.[2] Precipitation-smelting, simple, had practically gone out of use, although its reactions enter into the modern blast-furnace practice, as do also those of the roast-reaction method.

In the treatment of argentiferous lead-ores, a combination of the roast-reduction, roast-reaction and precipitation-methods had been developed. Ores low in lead were still roasted, chiefly in hand-worked reverberatories (the mechanical furnaces not having been proved well adapted to lead-bearing ores), while the high loss of lead and silver in sinter or slag-roasting of rich galenas had caused those processes to be abandoned, and such ores were charged raw into the blast-furnace, the part of their sulphur which escaped oxidation therein reappearing in the form of matte. In the roast-reduction smelting of galena alone, however, there was no way of avoiding the roasting of the whole, or at least a very large percentage of the ore, and in this roasting the ore had necessarily to be slagged or sintered in order to eliminate the sulphur to a satisfactory extent. This is exemplified in the treatment

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*Read at the London Meeting of the American Institute of Mining Engineers.

[1] *Engineering and Mining Journal*, September 2, 1905.

[2] This term is inexact, because the hearths employed in the United States are not strictly "Scotch hearths," but they are commonly known as such, wherefore my use of the term.

of the galena concentrate of south-eastern Missouri at the present time.

Until the two new Scotch-hearth plants at Alton and Collinsville, Ill., were put in operation, the three processes of smelting the southeastern Missouri galena were about on an equal footing. Their results per ton of ore containing 65 per cent. of lead were approximately as follows. (Percentages of lead in Missouri practice are based on the wet assay; among the silver-lead smelters of the West the fire-assay is still generally employed.)

Method.	Cost.	Extraction. Per Cent.
Reverberatory	$6.50-$7.00	90-92
Scotch-hearth	$5.75-$6.50	87-88
Roast-reduction	$6.00-$7.00	90-92

The new works employ the Scotch-hearth process, with bag-houses for the recovery of the fume, which previously was the weak point of this method of smelting. This improvement did not originate at either Alton or Collinsville, having been previously in use at the works of the Missouri Smelting Company at Cheltenham, St. Louis, but the idea originated from the practice of the Picher Lead Company, of Joplin, Mo. This improvement led to a large increase in the recovery of lead, so that the entire extraction is now approximately 98 per cent. of the content of the ore, while, on the other hand, the cost of smelting per ton of ore has been reduced through the increased size of these plants and the introduction of improved means for handling ore and material. The practice of these works represents the highest efficiency yet obtained in this country in the smelting of high-grade galena-concentrate, and probably it can not be equalled even by the Huntington-Heberlein and similar processes. The Scotch-hearth and bag-house process is therefore the one of the older methods of smelting which will survive.

In the other methods of smelting, a large proportion of the cost is involved in the roasting of the ore, which amounts in hand-worked reverberatory furnaces to from $2 to $2.50 per ton. Also, the larger proportion of the loss of metal is suffered in the roasting of the ore, this amounting to from 6 to 8 per cent. of the metal content of such ore as is roasted. The loss of lead in the combined process of treatment depends upon the details of the process. The chief advantage of lime-roasting in the treatment of this class of ore is in the higher extraction of metal which it affords. This should rise to 98 per cent. That figure, indeed, has been surpassed in operations on a large scale, extending over a considerable period.

In the treatment of the argentiferous ores of the West, different conditions enter into the consideration. In the working of those ores, the present practice is to roast only those which are low in lead, and charge raw into the blast-furnace the rich galenas. The cost of roasting is from $2 to $2.50 per ton; the cost of smelting is about $2.50 per ton. On the average about 0.4 ton of ore has to be roasted for every ton that is smelted. The cost of roasting and smelting is therefore about $3.50 per ton. In good practice the recovery of silver is about 98 per cent. and of lead about 95 per cent., reckoned on the fire-assay.

In the treatment of these ores, the lime-roasting process offers several advantages. It may be performed at less than the cost of ordinary roasting. (This refers especially to the Savelsberg process.) The loss of silver and lead during the roasting is reduced to insignificant proportion. The sulphide-fines which must be charged raw into the blast-furnace are eliminated, inasmuch as they can be efficiently desulphurized in the lime-roasting pots without significant loss; all the ore to be smelted in the blast-furnace, therefore, can be delivered to it in lump form, whereby the speed of the blast-furnace is increased and the wind-pressure required is decreased. Finally, the percentage of sulphur in the charge is reduced, producing a lower matte-fall, or no matte-fall whatever, with consequent saving in expense of retreatment. In the case of a new plant, the first cost of construction and the ground-space occupied are materially reduced. Before discussing more fully the extent and nature of these savings, it is advisable to point out the differences among the three processes of lime-roasting that have already come into practical use.

In the Huntington-Heberlein process, the ore is mixed with suitable proportions of limestone or silica (or quartzose ore), and is then partially roasted, say, to reduction of the sulphur to one-half. The roasting is done at a comparatively low temperature, and the loss of metals is consequently small. The roasted ore is dampened and allowed to cool. It is then charged into a hemispherical cast-iron pot, with a movable hood which covers the top and conveys off the gases. There is a perforated grate in the bottom of the pot, on which the ore rests, and air is introduced through a pipe entering the bottom of the pot, under the grate. A small quantity of red-hot calcines from the roasting furnaces is thrown on the grate to start the reaction; a layer of cold, semi-roasted ore is put upon it, the air-blast is turned on and reaction begins, which manifests itself by the copious evolution of sulphur-fumes. These consist chiefly of sulphur dioxide, but they contain more or less trioxide, which is evident from the solution of copperas that trickles from the hoods and iron smoke-pipes, wherein the moisture condenses. As the reaction progresses, and the heat creeps up, more ore is introduced, layer by layer, until the pot is full. Care is taken by the operator to compel the air to pass evenly and gently through the charge, wherefore he is watchful to close blow-holes which develop in it. At the end of the operation, which may last from 4 to 18 hrs.,

Nikabau River, on the Route to Chibougamau.

Big Quartz Vein, near Calcite Bay, Chibongamau.

the ore becomes red hot at the top. The hood is then pushed up, and the pot is turned on its trunnions, by means of a hand-operated wheel and worm-gear, until the charge slides out, which it does as a solid, semi-fused cake. The pot is then turned back into position. Its design is such that the air-pipe makes automatic connection, a flanged pipe, cast with the pot, settling upon a similarly flanged pipe communicating with the main, a suitable gasket serving to make a tight joint. The pots are set at an elevation of about 12 ft. above the ground, so that when the charge slides out the drop will break it up to some extent; moreover, it is caused to fall on a wedge, or similar contrivance, to assist the breakage. After cooling, it is further broken up to furnace-size by wedging and sledging; the lumps are forked out, and the fines screened and returned to a subsequent charge for completion of their desulphurization.

The Savelsberg process differs from the Huntington-Heberlein in respect to the preliminary roasting, which, in the Savelsberg process, is omitted, the raw ore, mixed with limestone and silica, being charged directly into the converter. The Savelsberg converter is supported on a truck, instead of being fixed in position, but otherwise its design and management are quite similar to those of the Huntington-Heberlein converter. In neither case are there any patents on the converters. The patents are on the processes. In view of the litigation that has already been commenced between their respective owners, it is interesting to examine the claims.

The Huntington-Heberlein patent (U.S. No. 600,347, issued March 8, 1898, applied for December 9, 1896) has the following claims:—

1. The herein-described method of ozidizing sulphide-ores of lead preparatory to reduction to metal, which consists in mixing with the ore to be treated an oxide of an alkaline-earth metal, such as calcium oxide, subjecting the mixture to heat in the presence of air, then reducing the temperature, and finally passing air through the mass to complete the oxidation of the lead, substantially as and for the purpose set forth.

2. The herein-described method of ozidizing sulphide-ores of lead preparatory to reduction to metal, which consists in mixing calcium oxide or other oxide of an alkaline-earth metal with the ore to be treated, subjecting the mixture, in the presence of air, to a bright-red heat (about 700° C.), then cooling down the mixture to a dull-red heat (about 500° C.), and finally forcing air through the mass until the lead-ore, reduced to an oxide, fuses, substantially as set forth.

3. The herein-described method of oxidizing lead sulphide in the preparation of the same for reduction to metal, which consists in subjecting the sulphide to a high temperature in the presence of an oxide of an alkaline-earth metal, such as calcium oxide, and oxygen, and then lowering the temperature, substantially as set forth.

Adolf Savelsberg, in U.S. Patent No. 755,598 (issued March 22, 1904, applied for December 18, 1903), claims:—

1. The herein-described process of desulphurizing lead-ores, which consists in mixing raw ore with limestone and then subjecting the mixture to the simultaneous application of heat and a current of air in sufficient proportions to substantially complete the desulphurization in one operation, substantially as described.

2. The herein-described process of desulphurizing lead-ores, which process consists in first mixing the ores with limestone, then moistening the mixture, then filling it without previous roasting into a chamber, then heating it and treating it by a current of air, as and for the purpose described.

3. The herein-described process of desulphurizing lead-ores, which consists in mixing raw ores with limestone, then filling the mixture into a chamber, then subjecting the mixture to the simultaneous application of heat and a current of air in sufficient proportions to substantially complete the desulphurization in one operation, the mixture being introduced into the chamber in partial charges introduced successively at intervals during the process, substantially as described.

4. The herein-described process of desulphurizing lead-ores, which process consists in first mixing the ores with limestone, then moistening the mixture, then filling it without previous roasting into a chamber, then heating it and treating it by a current of air, the mixture being introduced into the chamber in partial charges introduced successively at intervals during the process, as and for the purpose described.

5. The herein-described process of desulphurizing lead-ores, which process consists in first mixing the ores with sufficient limestone to keep the temperature of the mixture below the melting-point of the ore, then filling the mixture into a chamber, then heating said mixture and treating it with a current of air, as and for the purpose described.

6. The herein-described process of desulphurizing lead-ores, which process consists in first mixing the ores with sufficient limestone to mechanically separate the particles of galena sufficiently to prevent fusion, and to keep the temperature below the melting-point of the ore by the liberation of carbon dioxide, then filling the mixture into a chamber, then heating said mixture and treating it with a current of air, as and for the purpose described.

The Carmichael-Bradford process differs from the Savelsberg by the treatment of the raw ore mixed with gypsum instead of limestone, and differs from the Huntington-Heberlein both in respect to the use of gypsum and the omission of the preliminary roasting. The Carmichael-Bradford process has not been threatened with litigation, so far as I am aware. The claims of its original patent read as follows:[3]—

1. The process of treating mixed sulphide-ores, which consists in mixing with said ores a sulphur compound of a metal of the alkaline earths, starting the reaction by heating the same, thereby oxidizing the sulphide and reducing the sulphur compound of the alkali metal, passing a current of air to oxidize the reduced sulphur compound of the metal of the alkalies preparatory to acting upon a new charge of sulphide-ores, substantially as and for the purpose set forth.

2. The process of treating mixed sulphide-ores, which consists in mixing calcium sulphate with said ores, starting the reaction by means of heat, thereby oxidizing the sulphide-ores, liberating sulphurous-acid gas, and converting the calcium sulphate into calcium sulphide, and oxidizing the calcium sulphide to sulphate preparatory to treating a fresh charge of sulphide-ores, substantially as and for the purpose set forth.

The process described by W. S. Bayston, of Melbourne (Australian Patent No. 2,862), appears to be identical with that of Savelsberg.

Irrespective of the validity of the Savelsberg and Carmichael-Bradford patents, and without attempting to minimize the ingenuity of their inventions and the importance of their discoveries, it must be conceded that the merit for the invention and introduction of lime-roasting of galena belongs to Thomas Huntington and Ferdinand Heberlein. The former is an American, and this is the only claim that the United States can make to a share in this great improvement in the metallurgy of lead. It is to be regretted, moreover, that of all the important lead-smelting countries of the world, America has been the most backward in adapting it.

The details of the three processes and the general results accomplished by them have been rather fully described in a series of articles recently published in the *Engineering and Mining Journal.* There has been, however, comparatively little discussion as to costs; and, unfortunately, the data available for analysis are extremely scanty, due to the secrecy with which the Huntington-Heberlein process, the most extensively exploited of the three, has been veiled. Nevertheless, I may attempt an approximate estimation of the various details, taking the Huntington-Heberlein process as the basis.

The ore, limestone and silica are crushed to pass a 4-mesh screen. This is about the size to which it would be necessary to crush as preliminary to roasting in the ordinary way, wherefore the only difference in cost is the charge for crushing the limestone and silica, which in the aggregate may amount to one-sixth of the weight of the raw sulphide, and may consequently add 2 to 2.5c. to the cost of treating a ton of ore. The mixing of ore and fluxes may be costly or cheap, according to the way of doing it. If done in a rational way it ought not to cost more than 10c. per ton of ore, and may come to less. The delivery of the ore from the mixing-house to the roasting-furnaces ought to be done entirely by mechanical means, at insignificant cost.

The Heberlein roasting-furnace, which is used in connection with the "H.-H." process, is simply an improvement on the old Brunton calciner—a circular furnace, with revolving hearth. The construction of this furnace, according to American designs, is excellent. The hearth is 26 ft. in diameter; it is revolved at slow speed, and requires about 1.5 h.p. A flange at the periphery of the hearth dips into sand in an annular trough, thus shutting off air from the combustion-chamber, except through the ports designed for its admittance. The mechanical construction of the furnace is workmanlike, and the mechanism under the hearth is easy of access and comfortably attended to.

A 26-ft. furnace roasts about 80,000 lb. of charge per 24 hrs. In dealing with an ore containing from 20 to 22 per cent. of sulphur, the latter is reduced to about 10 or 11 per cent., the consumption of coal being about 22.5 per cent. of the weight of the charge. The hearth-efficiency is about 150 lb. per sq. ft., which, in comparison with ordinary roasting, is high. The coal-consumption, however, is not corresponding low. Two furnaces can be managed by one man per 8 hr. shift. On the basis of 80 tons of charge ore per 24 hrs., the cost of roasting should be approximately as follows:—

Labor: 3 men at $2.50.	$7.50
Coal: 18 tons at $2.00.	36.00
Power	3.35
Repairs	3.35
Total..	$50.20 for 80 tons, or 63c per ton.

In the above estimate repairs have been reckoned at the same amount as is experienced with Bruckner cylinders, and the cost of power has been allowed for with fair liberality. The estimated cost of 63c. per ton is comparable with the $1.10 to $1.45 per ton, which is the result of roasting in Bruckner cylinders in Colorado, reducing the ore to from 4.5 to 6 percent. of sulphur.

The Heberlein furnace is built up to considerable elevation above the ground-level, externally somewhat resembling the Pearce turret-furnace. This serves two purposes: (1) it affords ample room under the hearth for attention to the driving mechanism; and (2) it enables the ore to be discharged by gravity into suitable hoppers, without the construction of subterranean gang-ways. The ore discharges continuously from the furnace, at dull-red heat, into a brick bin, wherein it is cooled by a water-spray. Periodically, a little ore is diverted into a side-bin, in which it is kept hot for starting a subsequent charge in the converter.

[3] A. D. Carmichael, U. S. Patent No. 705,904, July 29, 1902.

The cooled ore is conveyed from the receiving-bins at the roasting-furnaces to hopper-bins above the converters. If the tramming be done by hand the cost, with labor at 25c. per hr., may be approximately 12.5c per ton of ore, but this should be capable of considerable reduction by mechanical conveyance.

The converters are hemispherical pots of cast-iron, 9 ft., in diameter at the top and about 4 ft. in depth. They are provided with a circular, cast-iron grate, which is 0.75 in. thick and 6 ft. in diameter, and is set and secured horizontally in the pot. This grate is perforated with holes 0.75 in. in diameter, 2 in. apart, centre to centre, and is similar to the Wetherill grate employed in zinc oxide manufacture. The pot itself is about 2.5 in. thick at the bottom, thinning to about 1.5 in. at the rim. It is supported on trunnions, and is geared for convenient turning by hand. The blast-pipe which enters the pot at the bottom is 6 in. in diameter.

Two roasting-furnaces and six converters are rated nominally as a 90-ton plant. This rating, however, is considerably in excess of the actual capacity, at least on certain ores. The time required for desulphurization in the converter apparently depends a good deal upon the character of the ore. The six converters may be arranged in a single row, or in two rows of three in each. They are set so that the rim of the pot, when upright, is about 12 ft. above the ground-level. A platform gives access to the pots. One man per shift can attend to two pots. His work consists in charging them, which is done by gravity, spreading out the charge evenly in the pot, closing any blow-holes which may develop, and at the end of the operation raising the hood (which covers the pot during the operation) and dumping the pot. The work is easy. The conditions under which it is done are comfortable, both as to temperature and atmosphere. Reports have shown a great reduction in liability to lead poisoning in the works where the "H.-H." process has been introduced.

A new charge is started by kindling a small wood or coal fire on the grate, then throwing in a few shovelfuls of hot calcines, and finally dropping in the regular charge of damp ore (plus the fluxes previously referred to). The charge is introduced in stages, successive layers being dropped in and spread out as the heat rises. At the beginning the blast is very low—about 2 oz. It is increased as the height of the ore in the pot rises, finally attaining about 16 oz. The operation goes on quietly, the smoke rising from the surface evenly and gently, precisely as in a well-running blast furnace. While the charge is still black on top, the hand can be held with perfect comfort inside of the hood, immediately over the ore. This explains, of course, why the volatilization of silver and lead is insignificant. There is, moreover, little or no loss of ore as dust, because the ore is introduced damp, and the passage of the air through it is at low velocity. In the interior of the charge, however, there is high temperature (evidently much higher than has been stated in some descriptions), as will be shown further on. The conditions in this respect appear to be analogous to those of the blast-furnace, which, though smelting at a temperature of about 1,200° C. at the area of the tuyeres, suffers only a slight loss of silver and lead by volatilization.

At the end of the operation in the "H.-H." pot, the charge is dull red at the top, with blow-holes, around which the ore is bright red. Imperfectly-worked charges show masses of well-fused ore, surrounded by masses of only partly altered ore, a condition which may be ascribed to the irregular penetration of air through the charge, affording good evidence of the important part which air plays in the process. A properly-worked charge is tipped out of the pot as a solid cake, which, in falling to the ground, breaks into a few large pieces. As they break, it appears that the interior of the charge is bright red all through, and there is a little molten slag which runs out of cavities, presumably spots where the chemical action has been most intense. When cold, the thoroughly desulphurized material has the appearance of slag-roasted galena. Prills of metallic lead are visible in it, indicating reaction between lead sulphide and lead sulphate.

The columns of the structure supporting the pots should be of steel, since fragments of the red-hot ore dumped on the ground are likely to fall against them. To hasten the cooling of the ore, water is sometimes played on it from a hose. This is bad, since some is likely to splash into the still inverted pot, leading to cracks. The cracked pots at certain works appear to be due chiefly to this cause, in the absence of which the pots ought to last a long time, inasmuch as the conditions to which they are subjected during the blowing-process are not at all severe. When the ore is sufficiently cold it is further broken up, first by driving in wedges, and finally by sledging down to pieces of orange size, or what is suitable for the blast-furnace. These are forked out, leaving the fine ore, which comes largely from the top of the charge, and is therefore only partially desulphurized. The fines are, therefore, retreated with a subsequent charge. The quantity is not excessive; it may amount to 7 or 8 per cent. of the charge.

The breaking up of the desulphurized ore is one of the problems of the process, the necessity being the reduction of several large pieces of fused, or semi-fused, material weighing two or three tons each. When done by hand only, as is usually (perhaps always) the practice, the operation is rather expensive. It would appear, however, to be not a difficult matter to devise some mechanical aids for this process—perhaps to make it entirely mechanical. When done by hand, a six-pot plant requires six men per shift sledging and forking. With 8-hr.

shifts, this is 18 men for the breaking of about 60 tons of material, which is about 3 1-3 tons per man per 8 hrs. With labor at 25c. per hour, the cost of breaking the fused material comes to 60c. per ton. It may be remarked, for comparison, that in breaking ore as it ordinarily comes, coarse and fine together, a good workman would normally be expected to break from 5 to 5.5 tons in a shift of 8 hrs.

The ordinary charge for the standard converter is about 8 tons (16,000 lb.) of an ore weighing 166 lb. per cu. ft. With a heavier ore, like a high-grade galena, the charge would weight proportionately more. The time of working off a charge is decidedly variable. Accounts of the operation of the process in Australia tell of charge-workings in from 3 to 5 hrs., but this does not correspond with the results reported elsewhere, which specify times of from 12 to 18 hrs. Assuming an average of 16 hrs., which was the record of one plant, six converters would have capacity for about 72 tons of charge per 24 hrs., or about 58 tons of ore, the ratio of ore to flux being 4:1. The loss in weight of the charge corresponds substantially to the replacement of sulphur by oxygen, and the expulsion of carbon dioxide. The finished charge contains, on the average, from 3 to 5 per cent. of sulphur. This is about the same as the result achieved in good practice in roasting lead-bearing ores in hand-worked reverberatory furnaces; but curiously the "H.-H." product, in some cases at least, does not yield any mattte, to speak of, in the blast-furnace,—the product delivered to the latter being evidently in such condition that the remaining sulphur is almost completely burned off in the blast-furnace. This is an important saving effected by the process. In calculating the value of an ore, sulphur is commonly debited at the rate of 25c. per unit, which represents approximately the cost of handling and reworking the matte resulting from it. The practically complete elimination of matte-fall rendered possible by the "H.-H." process, however, may not be an unmixed blessing. There may be, for example, a small formation of lead sulphide which causes trouble in the crucible and lead-wall; and results in furnace difficulties and the presentation of a vexatious between-product.

It may now be attempted to summarize the cost of the converting process. Assuming the case of an ore assaying lead, 50; of iron, 15; sulphur, 22; silica, 8, and alumina, etc., 5 per cent., let it be supposed that it is to be fluxed with pure limestone and pure quartz, with the aim to make a slag containing silica, 30; ferrous oxide, 40; and lime, 20 per cent. A ton of ore will make, in round numbers, 1,000 lbs. of slag, and will require 344 lbs. of limestone and 130 lbs., or, we may say roughly, one ton of flux must be added to four tons of ore, wherefore the ore will constitute 80 per cent. of the charge. In reducing the charge to 3 per cent. of sulphur it will lose ultimately through expulsion of sulphur and carbon dioxide (of the limestone) about 20 per cent. in weight, wherefore the quantity of material to be smelted in the blast-furnace will be practically equivalent to the raw sulphide-ore in the charge for the roasting-furnaces, but in the roasting-furnace the charge is likely to gain weight, because of the formation of sulphates. Taking the charge, which I have assumed above, and reckoning that as it came from the roasting-furnace it will contain 10 per cent. of sulphur, all in the form of sulphate, either of lead or of lime, and that the iron be entirely converted to ferric oxide, in spite of the expulsion of the carbon dioxide of the limestone and the combustion of a portion of the sulphur of the ore as sulphur dioxide, the charge will gain in weight in the ratio of 1 : 1.18. This, however, is too high, inasmuch as a portion of the sulphur will remain as sulphide, while a portion of the iron may be as ferrous oxide. The actual gain in weight will consequently be probably not more than one-tenth. The theoretical calculation elsewhere will illustrate the changes.

It may be assumed that for every ton of charge (containing about 80 per cent. of ore) there will be 1.1 ton of material to go to the converter, and that the product of the latter will be 0.9 of the weight of the original charge of raw material.

Each converter requires 400 cu. ft. of air per min. The blast-pressure is variable, as different pots are always at different stages of the process; but assuming the maximum of 16 oz. pressure, with a blast main of sufficient diameter (at least 15 in.)

	Raw Charge.	Semi-Roasted Charge.	Finished Charge.
ore	1,000 lb. Pb.	1,154 lb. PbO.	1,154 lb. PbO.
	300 lb. Fe.	428 lb. Fe_2O_3.	428 lb. Fe_2O_3 (?)
	160 lb. SiO_2.	160 lb. SiO_2.	160 lb. SiO_2.
	100 lb. Al_2O_3, etc.	100 lb. Al_2O_3, etc.	100 lb. Al_2O_3, etc.
	440 lb. S.	300 lb. S.	68 lb. S.
flux	130 lb. SiO_2.	130 lb. SiO_2.	130 lb. SiO_2.
	344 lb. $CaCO_3$.	193 lb. CaO.	193 lb. CaO.
	....	450 lb. O.	....
	2,474 lb.	2,915 lb. 10 per cent. S.	2,233 lb. 3 per cent. S.

Ratios :
2,474 : 2,915 : : 1 : 1.18.
2,915 : 2,233 : : 1 : 0.76⅔.
2,474 : 2,233 : : 1 : 0.90.

and the blower reasonably near the battery of pots, the total requirement is 21 h.p. The cost of converting will be approximately as follows:—

Labor: 3 foremen at $3.20. .	$9.60
9 men at $2.50..	22.50
Power: 21 h.p. at 30c.	6.30
Supplies, repairs and renewals..	5.00
Total..	$43.40=60c per ton of charge

The cost of converting is, of course, reduced directly as the time is reduced. The above estimate is based on unfavorable conditions as to time required for working a charge.

The total cost of treatment from the initial stage to the delivery of the desulphurized ore to the blast-furnaces, will be, per 2,000 lbs. of charge, approximately as follows:—

Crushing, 1.0 ton at 10c..	$0.10
Mixing, 1.0 ton at 10c..	0.10
Roasting, 1.0 ton at 63c..	0.63
Delivering, 1.1 ton to converters at 12c..	0.13
Converting, 1.1 ton at 60c..	0.66
Breaking, 0.9 ton at 60c..	0.54
Total	$2.15

The cost per ton of ore will be $216 ÷ 80 = $2.70. Making allowance for the crushing of the ore, which is not ordinarily included in the cost of roasting, and possibly some overestimates, it appears that the cost of desulphurization by this method, under the conditions assumed in this paper, is rather higher than in good practice with ordinary hand-worked furnaces, but it is evident that the cost can be reduced to approximately the same figure by introduction of improvements, as, for example, in breaking the desulphurized ore, and by shortening the time of converting, which is possible in the case of favorable ores. The chief advantage, however, must be in the further stage of the smelting. As to this, there is the evidence that the Broken Hill Proprietary Co., after the introduction of the Huntington-Heberlein process, was able to smelt the same quantity of ore in seven furnaces that formerly required thirteen. A similar experience is reported at Friedrichshutte, Silesia.

This increase in the capacity of the blast-furnace is due to three things: (1) In delivering to the furnace a charge containing a reduced percentage of fine ore, the speed of the furnace is increased, *i.e.*, more tons of ore can be smelted per sq. ft. of hearth-area. (2) There is less roasted matte to go into the charge. (3) Under some conditions the percentage of lead in the charge can be increased, reducing the quantity of gangue that must be fluxed.

It is difficult to generalize the economy that is effected in the blast-furnace process, since this must necessarily vary within wide limits because of the difference in conditions. An increase of from 60 to 100 per cent. in blast-furnace capacity does not imply a corresponding reduction in the cost of smelting. The fuel-consumption per ton of ore remains the same. There is saving in the power requirements, because the smelting can be done with a lower blast-pressure; also, a saving in the cost of reworking matte. Moreover, there will be a saving in other labor, in so far as portions thereof are not already performed at the minimum cost per ton. The net result under American conditions of silver-lead smelting can be determined closely only by extensive operations. That there will be an important saving, however, there is no doubt.

The cost of smelting a ton of charge at Denver and Pueblo, exclusive of roasting and general expense, is about $2.50, of which about $0.84 is for coke and $1.66 for labor, power and supplies. General expense amounts to about $0.16 additional. If it should prove possible to smelt in a given plant 50 per cent. more ore than at present without increase in the total expense, except for coke, the saving per ton of charge would be 70c. That is not to be expected, but the half of it would be a satisfactory improvement. With respect to sulphur in the charge, the cost is commonly reckoned at 25c. per unit. As compared with a charge containing 2 per cent. of sulphur there would be a saving rising toward 50c. per ton as the maximum. It is reasonable, therefore, to reckon a possible saving of 75c per ton of charge in silver-lead smelting, no saving in the cost of roasting, and an increase of about 3 per cent. in the extraction of lead, and perhaps 1 per cent. in the extraction of silver, as the net results of the application of the Hūntington-Heberlein process in American silver-lead smelting.

On a charge averaging 12 per cent. of lead and 33 oz. of silver per ton, an increase of 3 per cent. in the extraction of lead, and 1 per cent. in the extraction of silver would correspond to 25c and 35c respectively, reckoning lead at 3.5c per lb., and silver at 60c per oz. In this, however, it is assumed that all lead-bearing ores will be desulphurized by this process, which practically will hardly be the case. A good deal of pyrites, containing only a little lead, will doubtless continue to be roasted in Bruckner cylinders, and other mechanical furnaces, which are better adapted to the purpose than are the lime-roasting pots. Moreover, a certain proportion of high-grade lead-ore, which is now smelted raw, will be desulphurized outside of the furnace, at additional expense. It is comparatively simple to estimate the probable benefit of the Huntington-Heberlein process in the case of smelting-works which treat principally a single class of ore, but in such works as those in Colorado and Utah, which treat a wide variety of ores, we must anticipate a combination process, and await results of experience to determine just how it will work out. It should be remarked, moreover, that my estimates do not take into account the royalty on the process, which is an actual debit, whether it be paid on a tonnage-basis or be commuted in the form of a lump sum for the license to its use.

However, in view of the immense tonnage of ore smelted annually for the extraction of silver and lead, it is evident that the invention of lime-roasting by Huntington and Heberlein was an improvement of the first order in the metallurgy of lead.

In the case of non-argentiferous galena, containing 65 per cent. of lead (as in southeastern Missouri), comparison may be made with the slag-roasting and blast-furnace smelting of the ore. Here no saving in cost of roasting may be reckoned, and no gain in the speed of the blast-furnaces is to be anticipated. The only savings will be in the increase in the extraction of lead from 92 to 98 per cent., and the elimination of matte-roasting, which may be reckoned as amounting to 50c. per ton of ore. The extent of the advantage over the older method is so clearly apparent that it need not be computed any further. In comparison with the Scotch-hearth bag-house method of smelting, however, the advantage, if any, is not so certain. That method already saves 98 per cent. of the lead, and, on the whole, is probably as cheap in operation as the Huntington-Heberlein could be under the same conditions. The Huntington-Heberlein method has replaced the old roast-reaction method at Tarnowitz, Silesia, but the American Scotch-hearth method, as practiced near St. Louis, is likely to survive.

A more serious competitor, however, will be the Savelsberg process, which appears to do all that the Huntington-Heberlein process does, without the preliminary roasting. Indeed, if the latter be omitted (together with its estimated expense of 63c. per ton of charge, or 79c. per ton of ore), all that has been said in this paper as to the Huntington-Heberlein process may be construed as applying to the Savelsberg. The charge is prepared in the same way, the method of operating the converters is the same, and the results of the reactions in the converters are the same. The litigation which is pending between the two interests, Messrs. Huntington & Heberlein claiming that Savelsberg infringes their patent, will be, however, a deterrent to the extension of the Savelsberg process until that matter be settled.

The Carmichael-Bradford process may be dismissed with a few words. It is similar to the Savelsberg, except that gypsum is used instead of limestone. It is somewhat more expensive, because the gypsum has to be ground and calcined. The process works efficiently at Broken Hill, but it can hardly be of general application, because gypsum is likely to be too expensive, except in a few favored localities. The ability to utilize the converter-gases for the manufacture of sulphuric acid will cut no great figure, save in exceptional cases, as at Broken Hill; and, anyway, the gases of the other processes can be utilized for the same purpose, which is, in fact, being done in connection with the Huntington-Heberlein process in Silesia.

The cost of desulphurizing a ton of galena-concentrate by the Carmichael-Bradford process is estimated by the company controlling the patents as follows, labor being reckoned at $1.80 per 8 hrs., gypsum at $2.40 per 2,240 lbs., and coal at $8.40 per 2,240 lbs.:—

0.25 ton of gypsum	$0.60
Dehydrating and granulating gypsum	0.48
Drying mixture of ore and gypsum	0.12
Converting	0.24
Spalling sintered material	0.12
0.01 ton coal	0.08
Total	$1.64

The value of the lime in the sintered product is credited at 12c., making the net cost $1.52 per 2,240 lbs. of ore.

The low cost allowed for converting may be explained by the more rapid action that seems to be attained with the ores of Broken Hill than with some ores that are treated in North America, but the low figure estimated for spalling the sintered material appears to be highly doubtful.

The theory of the lime-roasting processes is not yet well established. It is recognized that the explanation offered by Huntington and Heberlein in their original patent specification is erroneous. There is no good evidence in the process, or any other, of the formation of the higher oxide of lime, which they suggest.

At the present time there are two views. In one, formulated most explicitly by Professor Borchers, there is formed in this process a calcium plumbate, which is an active oxidizing agent. A formation of this substance was also described by Carmichael in his original patent; but he considered it to be the final product, not the active oxidizing agent.

In the other view, the lime, or limestone, serves merely as a diluent of the charge, enabling the air to obtain access to the particles of galena, without liquefaction of the latter. The oxidation of the lead sulphide is therefore effected chiefly by the air, and the process is analogous to what takes place in the Bessemer converter or in the Germot process of smelting, or perhaps more closely to what might happen in an ordinary roasting-furnace, provided with a porous hearth, through which the air-supply would be introduced. Roasting-furnaces of that design have been proposed, and, in fact, such a construction is now being tested for blende-roasting in Kansas.

Up to the present time, the evidence is surely too incomplete to enable a definite conclusion to be reached. Some facts, however, may be stated.

There is already reaction to a certain extent between lead sulphide and lead sulphate, as in the reverberatory smelting-furnace, because prills of metallic lead are to be observed in the lime-roasted charge.

There is a formation of sulphuric acid in the lime-roasting, upon the oxidizing effect of which

Savelsberg lays considerable stress, because its action is to be observed on the iron-work in which it condenses.

Calcium sulphate, which is present in all of the processes, being specifically added in the Carmichael-Bradford, evidently plays an important chemical part, because not only is the sulphur trioxide expelled from the artificial gypsum, but also it is to a considerable extent expelled from the natural gypsum, which is added in the Carmichael-Bradford process; in other words, more sulphur is given off by the charge than is contained by the metallic sulphides alone.

Further evidence that lime does, indeed, play a chemical part in the reaction is presented by the phenomena of lime-roasting in clay dishes in the assay-muffle, wherein the air is certainly not blown through the charge, which is simply exposed to superficial oxidation, as in ordinary roasting.

The desulphurized charge dropped from the pot is certainly at much below the temperature of fusion, even in the interior, but we have no evidence of the precise temperature conditions during the process itself.

Pyrite and even zinc-blende in the ore are completely oxidized. This, at least, indicates intense atmospheric action.

The papers by Borchers,[4] Doeltz,[5] Guillemain[6] and Hutchings[7] may profitably be studied in connection with the reactions involved in lime-roasting. The conclusion will be, however, that their precise nature has not yet been determined. In view of the great interest that has been awakened by this new departure in the metallurgy of lead, it is to be expected that much experimental work will be devoted to it, which will throw light upon its principles, and, possibly, develop it from a mere process of desulphurization into one which will yield a final product in a single operation.

McGILL MINING SOCIETY.

A meeting of the McGill Mining Society was held in the McDonald Mining Building, on Friday, November 23rd, at 8.15 p.m.

The lecturer of the evening was Dr. F. D. Adams, F.G.S.A., F.R.S.C., Vice President of the Canadian Mining Institute, who gave a most interesting and instructive talk on "The Undeveloped Mineral Resources of the Dominion."

He first remarked how really important the mineral development of Canada is, being equivalent in value last year to two-thirds of our total agricultural exports. He pointed out that in the last twenty years the mineral production of Canada had increased over 600 per cent

Dr. Adams then took up our six most important mineral products beginning with coal and passing successively to gold, nickel, copper, silver and iron. He spoke first of the coal fields being worked in Nova Scotia and British Columbia, noticing that in the fields now being worked there are enormous reserves of coal, and then indicated the position and extent of other great coal fields, more particularly in the western part of the Dominion, which while they contained enormous supplies of mineral fuel remained as yet untouched by the miner.

Proceeding to the different metals he gave a short sketch of the chief places where they are found at present and indicated where, in all probability, our reserves will be discovered in future. He next took up our cement industries, mentioning the immense demand that was springing up for this material in all kinds of construction work and concluded by discussing the probability of diamonds being found in our Huronian rocks to the north.

A few minutes were taken up in the discussion of various points.

A hearty vote of thanks was then given to Dr. Adams and the meeting adjourned.

The audience numbered 125, consisting of members and their friends.

The next meeting of the society will be held in the McDonald Mining Building on Friday, January 11th, at 8.15 p.m., when Mr. Fritz Circle, E.M., will lecture on "Concentrating and Concentrating Plants."

All those who are interested are cordially invited to attend.

FROM THE BOUNDARY.

At the annual general meeting of the Granby Consolidated Mining, Smelting & Power Co., Ltd., at the company's New York office, 52 Broadway, the following financial statement was submitted to the shareholders for the year ending June 30, 1906, by George W. Wooster, the treasurer:—

Produced.

19,939,004 lbs. copper fine, sold at average price of $0.1778.

316,947 ounces silver, sold at average price of $0.6468.
50,020 ounces gold, sold at average price of $20.00.
Total amount realized, $4,751,058.69.

Cost.

Working expenses at mines and smelter, freight, refining, selling and general expenses		$2,697,164.81
Foreign ores purchased		230,276.83
		$2,927,441.64

Cost per ton of ore, including all expenses, $3.2988.

Net cost per pound of copper, after deducting values of gold and silver, $0.0835.

Surplus carried over from previous year		$1,554,875.27
Net profit for the year ending June 30, 1906		1,823,617.05
		$3,378,492.32
Less—		
Exploring expenses	$20,753.71	
Dividends paid	810,000.00	
		$830,753.71
Net surplus, June 30, 1906		$2,547,738.61

There has been expended in new construction, equipment at the mines, smelter and converter plants, etc., $105,075.14. For additional mining properties, $350,480.25. A total of $456,460.39.

[4] *Metallurgie*, 1905, II, No. 1, 1-6; *Engineering and Mining Journal*, Sept. 2, 1905, 398.

[5] *Metallurgie*, 1905, II, No. 19, 460-463; *Engineering and Mining Journal*, Jan. 27, 1906, 726.

[6] *Metallurgie*, 1905, II, No. 18, 433-443; *Engineering and Mining Journal*, March 10, 1906, 470.

[7] *Engineering and Mining Journal*, Oct. 21, 1905, 726.

The Big Vein on Portage Island, Chibougamau.

Shaft of a Cobalt mine from which much ore has come.

All development work, repairs and renewals have been charged to working expenses.

Mine development, 8,698 lineal feet.

Diamond drilling development, 11,505 lineal feet.

Granby ore smelted, 796,188 dry tons.

Foreign ore smelted, 36,158 dry tons.

Assets—June 30, 1906.

Cost of land, real estate, machinery, buildings, dwellings, and equipment	$14,859,044.22
Stocks, bonds and bills receivable	45,429.32
Cash and copper on hand	1,023,833.96
Fuel and store supplies	187,334.38
Total	$16,151,641.88

Liabilities.

Capital stock	$15,000,000	
In treasury	1,500,000	
Issued stock		$13,500,000.00
Accounts payable, current for month		102,466.87
Dividends collected on liquidator shares		1,436.40
Surplus		2,547,738.61
Total		$16,151,641.88

In his address to the shareholders President Jacob Langeloth referred with deep regret to the death, which occurred in February last, of John Stanton, one of the board of directors of the company. He stated that the tonnage output had largely increased in the last fiscal year, amounting to an increase of over 40 per cent. over the previous year. Briefly, he referred to the chief events of the year in the operations of the company, paying a high compliment to the local management for the way the emergency was met last winter when one of the huge ore crushers was burned, which was done without largely decreasing current production. In view of the higher price of copper ruling since last fall, it has been deemed wise to mine large quantities of ore carrying a smaller percentage of copper than the average run of the mines. Active work had been going on continually and large bodies of ore had been opened up by diamond drills in the Victoria and Aetna claims, where a new shaft is now being sunk and the necessary improvements installed for crushing and shipping this output, the first shipment from this outlet probably to be made at the end of this year.

He stated that development of the Gold Drop group, purchased a year ago, proved satisfactory, and for some months ore shipments from this part of the Granby group averaged over 200 tons per day. A tunnel is being pushed towards the Monarch property, owned by the company, also opening up satisfactory ore bodies. The length and width is not yet fully determined, but indications point to large bodies of ore, a considerable portion of which will soon be available for hoisting. These developments, Mr. Langeloth stated, have largely increased the tonnage of ore in sight over that extracted last year.

Further economies had been effected in practically every department, again resulting in great savings, and the board had felt justified in the payment of two three per cent. dividends, amounting together to $810,000, another one of three per cent. having meanwhile been paid on September 15 last.

Ex-senator Warner Miller, of New York, president of the Dominion Copper Co., Ltd., whose chief mines are located in this camp, has just sent a communication to shareholders, regarding the status of the corporation, the progress made since the present company took hold a year ago, and the favorable statement of the company as at July 31, 1906. Mr. Miller states that the work of pushing development has been steadily pursued under the supervision of the consulting engineer, M. M. Johnson, and that the Idaho and Rawhide mines are now in a position to furnish the additional tonnage necessary when the new furnace at the smelter goes into commission, thus doubling the output to 1,200 or 1,400 tons of ore daily. He also tells of the saving that will be made by the substitution of electricity for steam, shortly, the difference being as $30 per h.p. per annum is to $135, and resulting in an estimated saving of $100,000 per annum to the company in this one item alone.

The new giant furnace referred to, said to be the largest ever erected in British Columbia, has been shipped from the manufacturers in the east, and will be installed as soon as it arrives. Its capacity is to be about 800 tons per day, and by reason of labor saving and other devices it will, it is expected, make a saving of 20 per cent. in fuel, or an estimated saving of $100 per day. A new contract for converting the matter, the president states, will reduce the cost of this work about 25 per cent.

For the eight months that the company's smelter has been in blast—part of the time when one furnace—from December 31st, 1905, to July 31st, 1906, which has been largely a period of construction and development, 133,084 tons of ore were smelted, producing 3,220.89 tons of matte, having a total value of $640,128.97. The total operating cost, mining, smelting, marketing, etc., was $500,984.93, leaving a net profit for the eight months of $139,144.04.

President Miller also states that the results of the economies already introduced are beginning to be reflected in the company's earnings, the operations for the month of July producing earnings of $31,431.70. On this basis, the net profits of the present smelter for 12 months would exceed $300,000. As the new furnace will double the capacity of the plant and more, and with more economies yet to be put into effect, it is believed that the cost of producing copper can be reduced to not over eight cents per pound. The company has taken options on a number of claims in the district, and is now engaged in prospecting and exploring these properties, with a view to purchasing such as may prove valuable to the company.

Following is the balance sheet of the company, dated July 31, 1906:—

Assets.

Mines, smelter and other properties, including beneficial interest in certain of this company's stock, acquired under a plan of re-organization. Costs as of 31st July, 1905, including expenses of re-organization		$3,744,312.79
Additions since:—		
Smelter equip., etc.	$49,278.66	
Mine dev. and equip.	78,407.71	
Real estate, B.C.	3,975.00	
Miscellaneous	312.00	
		130,973.37
		$3,875,286.16
Stocks and shares		1,792.50
Office furniture, N.Y. and B.C.		740.00
Stores and fuel on hand		38,085.37
Sundry debtors:—		
B. C. Copper Co. matte	$117,476.50	
Mis. N.Y. and B.C.	3,013.06	
		120,489.56
Cash in banks and on hand:—		
New York	$17,789.93	
British Columbia	18,114.60	
		35,904.53
Total assets		$4,072,298.12

Liabilities.

Capital stock, auth., $5,000,000, 500,000 shares, $10 each.	
Whereof issued	$3,200,037.00
320,003, 7-10 shares at $10 each.	
First mortgage, 6 p.c., due July 1, 1915, $1,000,000.	
Whereof issued	700,000.00

Sundry creditors:—		
Open accounts, N.Y., B.C.	$61,371.66	
Res. Ins., taxes	3,573.84	
Bond int., coup. uncol	1,440.00	
Bond int. accrued	7,000.00	
Surplus accounts:—		
		73,885.50
Profit 8 months' oper. to date		98,875.62
Total		$4,072,298.12

Operating Account, Dr.

Mine operating accounts:—		
Operating expenses	$203,875.29	
Freight on ore	32,263.29	
		$236,021.58
Ore purchased		3,315.58
Smelter operating expenses:—		
Sample mill	$ 12,005.39	
Blast furnace	164,657.53	
Slag railway	10,457.08	
Power and light	20,571.26	
Pumping	2,227.77	
General expenses	1,370.11	
		211,289.14
General expenses, B.C.:—		
General	$10,718.25	
Office	5,015.36	
Laboratory	4,077.51	
Travelling	1,445.85	
		21,256.97
Matte freight		418.66
Salaries, offices, etc.	$11,537.24	
Professional services	11,358.75	
Travelling	2,408.78	
Rent N.Y. offices	520.00	
General office expenses	4,323.12	
		30,147.89
Bal. profit 8 months' operation		139,593.33
		$ 641,593.33

Profit and Loss Account, Dr.

Interest on 6 p.c. mortg. bonds	$ 42,545.26
Exchange	128.78
Bal. being profit, car. to bal. sheet	98,875.62
	$141,549.66

Cr.

Sales of matte	$640,128.97
Rents	1,464.36
	$641,593.33

Year to July, 1906, Cr.

Profit, operation acc., brot. down	$139,144.04
Interest bank deposits	2,405.62
	$141,549.66

The suitability of the Potter process for the recovery of zinc, from the tailings of any given ore, may be ascertained in the laboratory by placing a small portion of the ore in a large test tube, and adding about three or four times its bulk of a solution of sulphuric acid in water (containing say 2½ per cent. of the acid) and heating the mixture to about 190 degrees Fahrenheit. The sulphides will be seen to rise to the surface of the liquid as a scum whilst the gangue will be left at the bottom of the test tube.

MINERAL OUTPUT OF CALIFORNIA.

State Mineralogist Lewis E. Aubury, has issued from the State Mining Bureau a tabulated sheet showing the output in amounts, values and by counties of the mineral products of California, for the year 1905. This appears somewhat later than usual as the records of many companies were destroyed in the great fire and it took a longer time to get corrected addresses and obtain the desired information.

The following table shows the yield and value of mineral substances of California for the year 1905, as per returns received at the State Mining Bureau, San Francisco, in answer to inquiries sent to producers:—

	Quantity.		Value.
Asbestos	112	tons	$ 2,625
Asphalt	40,304	"	285,290
Bituminous Rock	24,753	"	60,436
Borax	46,334	"	1,019,158
Brick	286,618	M	2,273,786
Cement	1,265,553	bbls.	1,791,916
Chrome	40	tons	600
Clay	133,805	"	130,146
Coal	46,500	"	144,500
Copper	16,997,489	lbs.	2,650,605
Fuller's Earth	1,344	tons	38,000
Gems			148,500
Glass Sand	9,257	tons	8,121
Gold			19,197,043
Granite	228,738	cu. ft.	353,837
Gypsum	12,850	tons	54,500
Infusorial Earth	3,000	"	15,000
Lead	533,680	lbs.	25,083
Lime	616,995	bbls.	555,322
Limestone	192,749	tons	323,325
Lithia Mica	25	"	276
Macadam	1,440,455	"	942,503
Magnesite	3,933	"	16,221
Marble	73,303	cu. ft.	129,450
Mineral Paint	754	tons	4,025
Mineral Water	2,194,150	gals.	538,700
Natural Gas	148,345	M. cu. ft.	102,479
Paving Blocks	3,408	M.	134,347
Petroleum	34,275,701	bbls.	9,007,820
Platinum	200	oz.	3,320
Pyrites	15,503	tons	63,958
Quicksilver	24,655	flasks	886,081
Rubble	1,183,802	tons	774,267
Salt	77,118	"	141,925
Sandstone	302,813	cu. ft.	483,268
Silver			678,494
Slate	4,000	squares	40,000
Soapstone	300	tons	3,000
Soda	15,000	"	22,500
Tungsten		"	18,800
Total value			$43,069,227

The total yield of metallic substances, including gold and silver, was, for the year, $23,523,984 and in these are also copper, quicksilver, chrome, lead, pyrites, platinum and tungsten. This is the first year the latter substance has been produced in California.

IN GAY NEW YORK.

The following from "Bulls and Bears," may serve to beguile an idle ten minutes:

The Nipissing sensation which has been convulsing the Curb market has proved of sufficient size to excite the whole financial district. The sharp tongue of gossip is busy with the affair and everybody is trying to get at its true inwardness.

Stated in briefest phrase a syndicate headed by Daniel and Murray Guggenheim obtained from Captain Joseph De La Mar, Ellis P. Earle, E. C. Converse, and Ambrose Monell an option on 400,000 shares of Nipissing stock at $25 a share. This option was secured about the middle of October and was exercised the first day of November, upon which date the Guggenheim syndicate paid $2,500,000, the first of four instalments of $2,500,000 each, due at intervals of thirty days. The vendors held 60,000 shares as a forfeit. Immediately after announcement was made that the Guggenheims had bought one-third of the capital stock of the company on a basis of $30,000,000 for the entire issue the stock jumped from $25 a share to $34 a share amid great excitement and heavy trading. A few days before the second instalment fell due vague hints began to circulate that something was wrong with the title to the property; that ore taken from the lower workings was disappointing and that the Guggenheims were likely to abandon the deal. The management of the mine heard of these things and ran most of the rumors down to 71 Broadway, the building in which the Guggenheims have their offices. When approached for information the Guggenheims refused to say anything.

Up to within a few minutes before the close of the market Saturday the vendors and the Nipissing management were led to believe that the Guggenheims would make the second payment of $2,500,000 before twelve o'clock. Announcement to the contrary was not made until late in the afternoon, hours after the market and the banks had closed.

Meanwhile the price of Nipissing had broken from the high point of 34 down through 20 and yesterday it had a further slump to 15½, an apparent or paper loss on the whole capitalization of $22,000,000. Of course, no such loss in real money actually occurred, as about 700,000 out of the 1,250,000 shares still remain in the hands of the original Nipissing syndicate, which stock cost them at the beginning $2 a share, that being about the bed rock cost price to which was subsequently added something like $2 a share for promotion profits, commissions and inside graft of one sort and another.

It is reasonably certain that the Guggenheims while apparently out anywhere from $400,000 to $750,000 made up this loss by selling the market on the way down. They were not born yesterday. There is a report current on the Curb that they sold about 50,000 shares within two or three points of the top. It is noted in this connection that the Street was full of wild tips about that time that the stock would presently sell at $50 a share. Many speculators who were proud to be enrolled in the Guggenheim following bought Nipissing stock freely above 30. These devoted followers and the general public are the unlucky ones who were stung on the decline, and who lost real money. They may have suffered to the extent of $2,500,000 to $4,000,000. The rest of the shrinkage can properly and legitimately be put under the head of "paper losses."

The reputation of the Guggenheims has not been benefited by this Nipissing fiasco. For twenty years or more they have been in the business of smelting and refining ores and of developing mining properties. In the last named branch of their business they had achieved a reputation of driving sharp bargains. Their enemies called them mining "pawn brokers."

Nobody gives serious consideration to the plea that they discovered 45 days after getting the option, and 30 days after paying the first instalment of $2,500,000 thereon, that the title was defective. They had been buying properties for twenty years and are keenly alive to the necessity of having a clean bill of health on everything they touch. They never became immensely rich, paying $2,500,000 as an initial instalment on properties about which there could be a shadow of a doubt in title, at least, not with the astute "Sam" Untermeyer at their elbow. The fact is the Guggenheims were stung by the Cobalt Bug and while under the delirious influence of the virus took over at a high figure an option on a mining property, and afterwards regretted the bargain. The price might not have been extravagant, but it signalized a new departure by the Guggenheims. In the gray dawn of the morning after they wished they had not done it and immediately set about devising a means of escape.

The abandonment of the option was the result. But it was no sudden impulse that led to this finale; it was the deliberate judgment of shrewd mining men that they had possibly overstepped the bounds of strict pawnbroker prudence in agreeing to pay $10,000,000 for a third interest in a mining novelty—a strictly "tender-foot" proposition. The property might be worth more than they gave for it three-fold or five-fold, but they had made a venture, which, on cold reflection, did not strike them as being altogether in line with their past policy.

The course of Nipissing mining stock on the Curb during the last two weeks savors of stock rigging not in keeping with the high reputation hitherto borne by the Guggenheims. Their skirts may be clear of any connection with the jobbery but the trail leads unpleasantly close to their doors.

A mephitic and penetrating odor envelops the whole affair so far as it relates to Broad and Wall Streets—and Broadway.

It must be borne in mind, however, that the real value of the Nipissing mine has not in the slightest degree been affected. The management will continue to take out ore and convert it into money and dividends. On the other hand, the Guggenheims officially announce that so far as they are concerned the incident is closed, and that they are engaging themselves in the mining and smelting business. Furthermore, they deprecate the prevailing speculative craze in mining stocks and hope that the people will recover soon from the malady.

It is stated on high authority that on Thanksgiving Day John Hays Hammond wired from Cobalt to the Guggenheims that in his opinion Nipissing mine was better than ever but advising not to pay the second instalment until he could see them. This despatch adds another chapter to the mystery, and will still further arouse curiosity as to what was really behind the job which reached its sensational climax yesterday.

It is stated that fourteen cars loaded with ore from the Nipissing mine have been awaiting an opportunity to be treated at the Guggenheim Perth Amboy works for several days. This item is given for what it is worth and without comment.

COBALT SHIPMENTS.

The shipments of ore from the Cobalt District for the month of November consisted of 27 carloads, making in all, 1,449,580 lbs.

Nipissing mine, 4 shipments (199,720) lbs.) of carload each to New York.

Buffalo mine, 6 carloads (280,000) lbs.) to Perth Amboy.

La Rose mine, 8 shipments (495,000 lbs.) to New York.

Trethewey mine, 2 shipments (106,770 lbs.) to Perth Amboy.

Coniagas mine, 3 shipments to Perth Amboy and 1 shipment to Bergen Junction, in all 240,000 lbs.

Foster mine, 1 shipment (47,000 lbs.) to Bergen Junction.

Green Mehan mine, 1 shipment (84,050 lbs.) to Bergen Junction.

Nova Scotia mine, 1 shipment (47,040 lbs.) to New York.

BOOK REVIEWS.

The School of Mines Quarterly for November contains the second part of a paper on North American Index Fossils, by Messrs. A. W. Grabau and H. W. Shimer.

The following publications have been received:—

The Production of Bismuth in 1905, by C. C. Schnatterbeck.

The Production of Copper in 1905, by C. C. Schnatterbeck.

The Translations of the Engineering Society, School of Practical Science, Toronto, contains some interesting papers on Electrolytic Assaying, by H. E. T. Haultain; Notes on Pumping Conditions, by W. S. Pardoe; Cobalt Mines, by W. J. Blau, and a sympathetic history of the life of the highly popular Professor of Applied Chemistry, Dr. W. Hodgson Ellis.

The following publications, issued by the United States Geological Survey, have been received:—

The Production of Lead in 1905, by Charles Kirchhoff.

The Production of Borax in 1905, by Charles G. Yale.

The Production of Nitro-gas in 1905, by W. T. Griswold.

The Production of Bauxite and Aluminum in 1905.

We are in receipt of a Bulletin of the Geological Society of America, being pages 329-376 of Vol. 17. It deals with The Okanagan Composite Batholith of the Cascade Mountain System, the author being Reginald A. Daly. Mr. Daly sums up the result of his investigations in this region, by saying: "The problems of the Okanagan composite batholith illustrate once again, and on a large scale, the utmost dependence of a sound petrology upon structural geology. A suggested chief problem involves the relation of mountain-building to the repeated development of large bodies of superheated magma only a few miles beneath the surface of the mountain range. The fact of this association is apparent; its explanation is not here attempted.

The papers and addresses read and made, during the Eighth Annual Session of the American Mining Congress at El Paso, Texas, in November, 1905, have been issued in pamphlet form.

The volume includes papers on The Federal Government and the Mining Industry; the Geological Survey Coal Testing Plant; Forest Reserves and the Mining Industry; the Zinc Industry in the Rocky Mountain region; the Geological Survey and State Mining Bureau; Mine Drainage Districts; a Remedy for Inaccurate Patent Surveys; the Present State of Metallurgy of purely Silver Ores, (reproduced in the present issue), and other papers that will be found of interest to all connected with the mining industry. It is published at the office of the Secretary, Denver, Colo.

The sixth annual edition of the Copper Handbook, the only publication devoted exclusively to the copper industry, has been issued, being several months later than usual in appearance, owing to the sickness of the author, last spring, but matter of much later date has been used than in preceding issues, so that the book is as nearly up-to-date as its predecessors, and far more bulky and exhaustive in its treatment of the manifold phases of an industry that is world-wide in scope.

The Copper Handbook is encyclopaedic in scope, but is written throughout in plain language, easily understandable by those lacking a technical education. The work begins with a chapter on the history of copper followed by articles on the geology, chemistry, mineralogy, metallurgy and uses of the metal, with eight chapters devoted to condensed descriptions of the known copper deposits of the globe. A glossary of mining terms will be found useful to all readers not thoroughly conversant with practical mining, milling and smelting. The statistics of the copper trade and of copper share finances are covered in forty pages of highly condensed and accurate tables.

The major portion of the book is devoted to a chapter describing all known copper mines of the world, and listing every copper mining company of importance. This chapter is arranged alphabetically, by titles, rendering it self-indexing, and saving more than 50 pages of double-column index that otherwise would be required to merely give the titles of the 4,626 mines and companies listed in the book, there being 777 more titles than in the preceding annual edition. The descriptions range in length from two lines, in the case of unimportant, old and idle properties to nearly sixteen pages in the case of the Calumet & Hecla, a mine that employs seven thousand men and will have paid one hundred million dollars in dividends by April next.

The publisher makes the unusual offer of sending this book, on a week's approval, fully prepaid, to any address in the world, without any advance payment. This offer has been made for six years past, and the publisher states that of the many thousands of books so sent out less than three per cent. of the books retained remain unpaid for, the percentage of loss, on this plan of unlimited credit, being less than the average allowed by most business houses maintaining credit bureaus, which speaks well for the inherent honesty of the average man when put upon honor.

The Copper Handbook, Vol. VI, for 1906, issued Oct. 15th, 1,116 pages, octavo, brevier type; $5 in buckram binding, with gilt top, $7.50 in full library morocco, full gilt, Horace J. Stevens, editor and publisher, 278 Post Office Block, Houghton, Michigan.

PERSONALS.

W. H. Woodin, vice-president of the American Car & Foundry Company, will be elected to the board of the McKinley-Darragh-Savage Company at the meeting to be held this week.

A despatch from Cobalt says:—John Hays Hammond, the prospective president of the Nipissing Mines Company, arrived in Cobalt yesterday in a private car. It is expected he will remain a week in the camp and make a thorough inspection of the Nipissing.

MINING NOTES.

NOVA SCOTIA.

The Nova Scotia Steel and Coal Co. are preparing to add another blast furnace to their plant at Sydney Mines early next spring, which will enable them to produce about four hundred tons of pig iron per day. At present no ore is being smelted on account of the extensive repairs which are being made to the furnace, and which will not be completed before the latter part of December. The repair work, however, is being rushed, three shifts of bricklayers being kept constantly employed.

The rupture between the D. I. and S. S. Co. and the Dominion Coal Co. will keep all the collieries of the Nova Scotia Coal Company rushed all winter as a large percentage of the coal supply of the big syndicate company will be obtained here.

QUEBEC.

Mr. Rodolphe Forget, M.P., has for some time been in communication with the Bagnell Electric Company, of Cleveland, Ohio, in regard to the magnetic ore to be found at Bay St. Paul, and after sending their experts to Bay St. Paul they have purchased extensive property owned by Mr. E. H. Duval, of Levis, for the sum of $25,000. It is stated that operations on a very large scale will be commenced in the early spring, and several hundred men will be employed at the start. The proposed plant will be for the purpose of treating the magnetic ore, which exists at St. Urbain in the rear of Bay St. Paul. It may be said that some forty capitalists spent over three hundred thousand dollars developing these same mines, but as they did not have the proper machinery they were obliged to give up the enterprise.

A company is being formed for the purpose of developing 40,000 horse-power on the Quinze River, at the head of Lake Temiskaming. The power will be used for mining purposes in the Cobalt region, which is only eighteen miles away, and also for lighting purposes, and for an electric railway to run from New Liskeard to the source of the power, and thence to the foot of Quinze Lake, on which it is proposed to run a line of steamers to forward supplies for the construction of the Grand Trunk Pacific. Steamers will also ply on Lake Expanse.

There will also be ample power to operate a large pulp and saw-milling industry, to be established on the Quinze River. The surrounding country for over 300 miles square is a rich spruce forest, and the wood is easily accessible from the waters of the Upper Ottawa.

The names mentioned in connection with the undertaking are F. L. Wanklyn, vice-president of the Dominion

Coal Co.; Sturley Ogilvie, one of the directors of the Ogilvie Milling Co.; J. J. McFadden, lumberman, Sault Ste. Marie; John Ferguson, Renfrew; A. Barnett, Renfrew; James B. Klock, Montreal; Rinaldo McConnelly, of Ottawa, and P. J. Loughrin, of Toronto. Mr. Loughrin is for the present acting as secretary and will furnish any additional information that may be required.

ONTARIO.

A strong evidence of the wisdom with which the Ontario Government and the Railway Commission have dealt with the problem presented by the Temiskaming and Northern Ontario Railway is seen in the profits which that young road is already reaping, and the prophesy that it will pay a handsome revenue to the Provincial Treasury at the close of the year. For September the total earnings were $43,428, and the expenses were $31,816, leaving a net profit of $11,612. The cost of operation was thus about 73.3 per cent. of the gross receipts instead of the usual average of between 50 and 53 per cent. The reason for this was that several items which might have been charged to construction or capital account were included in the cost of operation. The commission has been undertaking the elevation of curves and the ballasting of the line. In addition the repairs to locomotives were added to the bill of cost, as were the charges for advertising at the Toronto and Ottawa fairs.

For the period of 1906, ending on Sept. 30, the gross earnings were $388,300, the expenses aggregated $243,789, and the net profits were $144,511. For a slightly shorter period in 1905 the net receipts were $71,342. At the same time the mileage travelled by trains on the road, which has been extended to Englehart, has risen from 12,030 miles in 1905 to 23,344 in 1906.

COBALT.

The White Silver Mining Co., better known under the name of Hargraves, has disposed of 120 acres of its holdings in the Kerr Lake district. The purchasers were Thomas Nevin & Sons, who, it is thought by some are acting for the United Exploration Co.

A despatch from Cobalt says:—The White Silver Company has disposed of 160 acres of its holdings in the Kerr Lake district, where they have parted with 120 acres to Thomas Nevins & Sons, who are thought by some to have been acting for either the United Cobalt Exploration Company or the Colonial. The property consists of three 40-acre claims, one of which adjoins the Drummond. They all lie in the third and fourth concessions, not far from the Jacobs, and brought a high figure.

An appeal has been entered in the Divisional Court on behalf of Alex. Cavanagh, a broker of Toronto, from a judgment of Chancellor Boyd, given at the non-jury trial last September, in favor of the defendant Glendinning in an action brought by Cavanagh for a commission on the sale of Cobalt property, known as the Cross Lake property. The plaintiff claimed ten per cent. commission on a selling price of $250,000, while the defendant maintains the commission was to be only five per cent.

Hon. F. R. Latchford, in discussing the Cobalt mining situation, has said he believed there was danger to the public and to the welfare of the country in the floating of numerous companies for speculative purposes. "They advertise extensively, and although the statements in these advertisements may not be exactly false, they are often misleading and extravagant."

"What is the prospect for the treatment of ore in this country next summer?" he was asked.

"That seems to be rather uncertain yet, so far as I know," he replied. "It would be a great boon if it could be brought about. The miners would get from $1,000 to $3,000 a carload more for the ore shipped. They get nothing now for the nickel arsenic and cobalt contained in the ore, and these are all valuable minerals."

At the last meeting of the Trethewey directors an interim dividend of 4 per cent. was declared. It is said to be the intention to pay this quarterly. The control of the company having changed hands, Messrs. W. G. Trethewey and F. W. Strathy retired from the board. Col. A. M. Hay and S. A. Wickett were elected in their stead and appointed president and vice-president respectively. The directorate otherwise remains as before, comprising Messrs. W. E. Carter, S. W. Black, and Ald. J. H. McGhie. The financial report showed 100,000 shares of stock in the treasury, a substantial amount of cash on hand, and returns from the last car shipment of $36,000. To pay the interim dividend $40,000 will be required. The plant is hitched to 185 horse-power and giving splendid results, according to the statement of the former president, Mr. W. G. Trethewey.

While it is proper to caution Ontario people against Cobalt investment, there is no reason they should be scared out of the market by wholesale warnings, says the editor of the Ottawa Citizen. If they had not been overcautious and incredulous during the past eighteen months they might have made a lot of money. Now the Americans are coming in and buying large interests in the camp and the cry will eventually go up that they have got everything and Canadians have got none of it. Meantime the Canadians who use good business judgment and enterprise stand no ordinary chance of making money. There is just the danger that the clamor of warning to the fool against being parted from his money may deter the men who have the brains and capacity to make money from taking advantage of the opportunity of a lifetime. Such men should go to Cobalt, examine into the opportunities and act accordingly.

The following official statement has been given out, signed by Mr. W. H. Blake, regarding the Foster mine:—The directors of the Foster Cobalt Mining Company have received the return of the first car of ore shipped by them. The net amount is $26,070.98. As there were a good many misstatements as to the value of the car, they think it well to make these figures public, but as cars grade very differently, do not intend in the future, unless it seems advisable, to make announcements with respect to other shipments. It might be misleading rather than the reverse to do so. Returns, however, will be given from time to time.

The development of the mine is progressing steadily and satisfactorily. Progress will be much more rapid when the steam plant is installed, and it is hoped that it will be in operation by the 1st of January.

The present management has been in control of the mine for about two months, and the shipments of ore which have been made and those which it is expected to make justify a dividend of 5 per cent., which was declared, and will be paid on the 1st of January to shareholders of record on the 15th day of December.

It is not deemed wise at the present time to fix the dates and amounts of subsequent dividends.

Twelve years ago, a settler named Anderson, located on lot 13, concession 1 Bucke township, comprising 320 acres. Part of the lot is excellent farming land and Anderson cleared it, stumped it, fenced it in part and built on it. He lived on it till 1904 when Thomas Little purchased his rights as a settler. Anderson had not obtained a patent for the land, but Little put in evidence that the requirements of the Public Lands Act were complied with by his predecessors. He put in in payment two veteran's certificates.

A man, Hunter, on the other hand, went out on the property of lots 13 and 14 and located mining claim R.L. 411, filed a plan by Surveyor Laird in December, 1904, and applied for the mining rights on 40 acres. He sunk a shaft and in July, 1905, sold for a good price to Ottawa and New York people, the payment being made after enquiry at the Crown Lands Department resulting in finding that in the patent Little got the mining rights were reserved to the Crown.

Hunter at once made application for a patent for the 40 acres known as Hunter's claim. The half is on lot 14 and Hunter made an arrangement with the settler Ferrell for the surface rights and the patent issued for the east half of 20 acres. As to the other portion the Department pointed out that it was usual to have consent from the owner of surface rights.

This was refused as Little claimed to have given an option to Frank M. Perry, who now claims the mining rights, because he alleges the patent given to Little was a mistake and should have included mining rights. Mr. Perry is applying to the Attorney-General for a fiat to bring suit to cancel the original patent to Little and have a new patent issue to carry the mining rights to Little or Perry.

ALBERTA.

Sir Sandford Fleming, in the course of an interview given by him recently in Winnipeg, stated:—

"We did not go quite so far as the summit of the range, but we sojourned for three days at a point which is now shown as Exshaw, some sixty miles this side of the continental divide. Exshaw will be better known in future generations than it is to-day. This spot has been selected for good and sufficient reasons as the site of a great industrial enterprise, which is warranted by the progress of Canada, and moreover, is necessary to the development of the great prairie region. There are minerals for the manufacture of Portland cement on the main line of the Canadian Pacific at Exshaw and here they are in close proximity and in greater profusion than elsewhere in the Dominion. By means of the railway the manufactured article can be widely distributed to the great advantage of the whole country. Incidentally, the new industry will permanently benefit the railway to the extent of furnishing for transportation something like a full trainload daily, perhaps eventually a great deal more.

"Already nearly a million dollars has been expended and the work of construction is in an advanced state. In five or six months it is expected that the factory will be in operation and the manufacture of Portland cement at Exshaw on a large scale will be commenced."

BRITISH COLUMBIA.

"Mason T. Adams, of New York, the newly-appointed manager of the Howe Sound Copper Company, is now in Vancouver, having just completed a three months' tour of inspection of the various properties controlled by the late George H. Robinson and his associates," says the Vancouver News-Advertiser. "It is reported that under the new management extensive improvements will be made both at the Britannia mines and at the Crofton smelter. At the mines it is probable that another aerial tram-line will be installed. The present tram cannot handle more than 600 tons per day. The daily output of ore at the mine is far in excess of this amount, and much more ore could be got out if it were possible to get it over the intervening three miles to tide-water.

"The water supply is also to be improved by some method of conservation. Last summer, during the hot weather, Britannia creek fell so low as to cause great inconvenience in the operation of the concentrating plant, which consumes a great deal of water. In addition to this the hydro-electric plant at the beach makes a heavy demand on the water supply. Plans for the installation of a 60-ton furnace at the smelter at Crofton are also under consideration. Mr. Adams will also have control of the Mount Andrews mines at Prince of Wales Island. He was appointed to his present position on the resignation of Mr. Henry Stern, who found that he had not sufficient time to devote to the work."

YUKON.

Klondike may figure before long in the world's output of asbestos. Two asbestos discovery claims were located on Hunker a few days ago, just above Gold Bottom town. Sherman Reid and Joseph O. Baker are the discoverers. They took enough asbestos from the surface of the seams on their claims to cover boilers which they are operating on Hunker. Some time ago asbestos was discovered on the hillsides back of Dawson, and quite a number of claims were staked. The same lead has an outcropping on the Klondike. Asbestos has also been found on the high bluff back of St. Mary's Hospital.

Some who have studied local conditions would not be surprised to see a big asbestos output in this country before long.

Extensive winter work is being prosecuted by the Sourdough Coal Company with the purpose of being ready to undertake important new traffic in the Yukon next spring. The Sourdough company is a part of the Fuller-Grant combination.

The company has many other details to follow up in establishing its big electrical generating plant at the mouth of the mine at Coal Creek and in conveying the power to Dawson and other places of utility.

Instead of hauling coal to Dawson it will send the electrical energy there by wire. The dredge on the Grotschier concession, the Williams dredge and other big plants will be supplied with power from the plant. The Dawson electric light service also will be supplied from the same source.

COAL NOTES.

NOVA SCOTIA.

The approximate output of the Dominion Coal Company's collieries for the month of November was 219,952 tons.

Shipments from the Cumberland Railway and Coal Company's collieries for the month of November were 14,123 tons.

The Port Hood mine is producing 250 tons daily. Development work is being driven with the view of a larger output next year. The workings to the deep have flattened off a little.

November will witness the start in sinking for two more lifts in the Inverness mine. This will mean an addition of some 1,400 feet to the length of the slope. It is proposed to work the new lifts on the long wall system which at the present time is in much favor.

The shaft of the Mulloch Hill Copper Company at Whycocomagh has been sunk thirty feet. The parties interested are greatly elated over the latest reports. The improvements in the quality of the ore surpasses what was expected at that depth. The company are enthusiastic and intend sinking a series of small shafts along the vein, to a depth of from 50 to 100 feet. By this method it is hoped to prove beyond doubt the value of the property.

THE MINING AND INDUSTRIAL SHARE MARKET.

(Specially reported for the CANADIAN MINING REVIEW by ROBERT MEREDITH & Co., Mining Brokers, 57 St. François Xavier St., Montreal.)

British Columbia stocks have not been active during the month, prices are firm and there is a steady demand for the better class. Consolidated Mining has had a rise on the settlement of the coal strike and the good returns from the St. Eugene.

The feature in the industrial shares has been the troubles of the Dominion Coal & Steel companies. Prices of these stocks have fluctuated, according to the different reports regarding the difficulties. In the mean time the investing public is standing aloof and no interest is being taken in any industrial securities outside of these two.

The latest quotations are as follows:—

	Bid.	Asked.
Consolidated Mines	150	155
Can. Gold Fields	7¼	8½
Granby Consolidated	13¾	14
Rambler-Cariboo	28	30
North Star	15	20
Monte Christo	2	3
White Bear	9	10
California	...	6
Virginia	6½	10
Deer Trail	...	2
International Coal	65½	70
Sullivan	7½	10
Cariboo-McKinney	3½	5½
Denoro	10½	16
Diamond Vale Coal	26	30
Dominion Copper	5	5¼
Novelty	3	3½
Dominion Coal (com.)	68	68½
Dominion Coal (pref.)	...	...
Dominion Iron & Steel (com.)	26¼	26½
Dominion Iron & Steel (pref.)	69	70
Intercolonial Coal (com.)	...	...
Intercolonial Coal (pref.)	...	...
Nova Scotia Steel & Coal Co.	70	71
Nova Scotia Steel & Coal (pref.)	115	...

INDUSTRIAL NOTES.

The Canadian Mine and Smelting Company of Vancouver, B.C., have bought a standard Dodge Crusher from Allis-Chalmers-Bullock, Limited, of Montreal.

The O'Brien Mines have added a number of "Ingersoll" rock drills and a "Lidgerwood" hoisting engine to their equipment already purchased from Allis-Chalmers-Bullock, Limited, of Montreal.

The Cleveland-Cobalt Mining Co., has purchased from Allis-Chalmers-Bullock, Limited, of Montreal, a mining plant, including three-belt driven compound "Ingersoll" air compressors, "Ingersoll" rock drills, plunger sinking pump, "Lidgerwood" hoisting engine and necessary fittings.

The Sullivan Machinery Company desires to announce the opening of a branch office and warehouse at 319 Howard street, San Francisco, California. The best obtainable facilities are provided for the prompt handling of business. Mr. Howard T. Walsh will be manager of this branch.

The McKinley-Darragh-Savage Mines have purchased from Allis-Chalmers-Bullock, Limited, of Montreal, a large amount of mining machinery, including a powerful cross-compound air and compound steam "Ingersoll" air compressor, "Ingersoll" rock drills, two 80 h.p. boilers, a feed water heater condenser, air pump, "Lidgerwood" standard mining hoisting engine, air receiver, etc.

Within the last few years Hadfield's Steel Foundry Company, Limited, Sheffield, have gone extensively into the manufacture of machines for stone and ore-breaking, and have established a special department for handling this portion of their business. This department also deals with all orders and inquiries for repair parts in connection with crushing machinery, such as jaw faces for stone breakers, tires for crushing rolls, edge-runner rings, tube and ball mill-lining plates, etc.

We illustrate one of the Hadfield and Jacks patented "Heclon" rock and ore breakers. These are of the gyratory type, and are made in various sizes, ranging from in capacity from two to 100 tons per hour. At present we understand that the company has in hand ten of the largest size, and one of these forms the subject of the illustration. They are intended for the Premier (Transvaal) Diamond Mines, Limited, and will be used for breaking the diamondiferous blue ground preparatory to its further reduction by large crushing rolls. This, we are informed, is one of the largest single orders ever placed for crushers of this type and the combined capacity of the ten machines will be upwards of 1,000 tons per hour. Great attention has been given to the perfection of details in the Heclon breaker, and it claims to be, from an economical point of view, the best machine on the market for the coarse breaking of stone or ore.

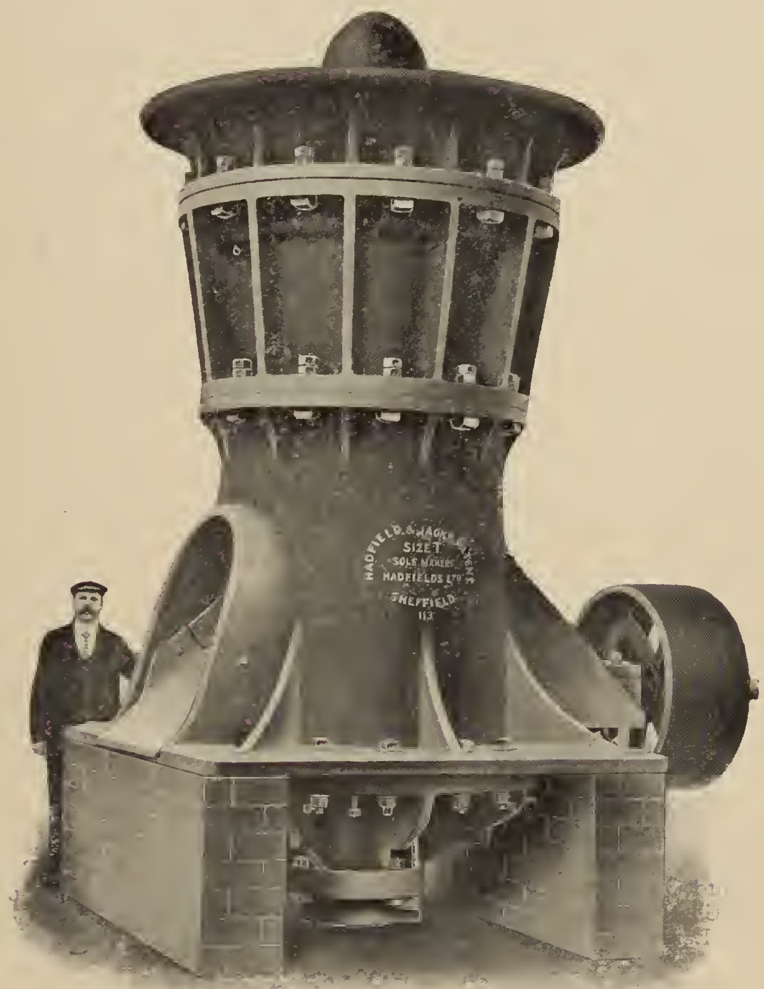
The machine embodies several improvements as compared with similar machines heretofore constructed. For the benefit of those who are not already familiar with the gyratory type of breaker we may point out that this machine has a true breaking action. At first sight it is difficult to understand that this is so, but if one bears in mind that the head and hollow shaft, which are practically one piece, do not revolve, and that all the motion is due simply to the excentric turning inside the bottom end of the hollow shaft it will be apparent, that, as regards any two diametrically opposite points on the crushing cone, the motion is simply backwards and forwards.

In the breaker under consideration a central shaft, with a ball at the upper end, is used to support the hollow shaft at a point were the motion is practically nothing, while the hollow shaft fitting over the outside of the excentric is said effectually to exclude all dust and dirt. The hollow shaft is much stronger than the usual solid shaft, and as this is the part that has to bear the whole of the crushing strain, the advantage is obvious.

Any lost motion in the gyratory type of breaker is detrimental to the output of broken stone. Therefore, it is important so to design the machine that renewals be easily and quickly made. As regards the upper end of the hollow shaft, when the bearing in the spider becomes worn, there is a steel bush provided which can be taken out and replaced with a new one, bored to suit the worn condition of the shaft. In the case of the excentric the bushes which are subject to wear are of anti-friction metal, and arranged in such a manner that spares can be carried in stock and slipped into position as required in order to reduce the lost time to a minimum. By raising or lowering the hollow shaft and crushing cone it is possible to vary the size of the broken product within certain limits, and the arrangement of worm wheel and worm in combination with a thread cut on the lower end of the central shaft has proved, so we are informed, a most satisfactory and effective method of accomplishing this purpose.

As might naturally be supposed the excentric bearing requires careful lubrication. The use of only the best oil is recommended by the makers, and the method of conducting it to the excentric is simple. Small tubes carried up through a hollow in the central shaft, with projecting drip pieces, deliver the lubricant in a thin, but steady stream to both inside and outside surfaces of the excentric. The flow is maintained by connecting pipes to a source of supply slightly higher than the discharge.

In the foregoing remarks we have only mentioned the novel features in the design of the breaker, but there are several points as regards the material employed in the construction which are worthy of attention. For example, the parts most subject to abrasive action of the stone are all protected with renewable linings of Hadfield's patented "Era" manganese steel, and the machine is designed especially with the idea of using these various linings in this material. The crushing cones, as already explained being of "Era" manganese steel, are simply thin mantles, secured to cast steel centres in such a way that when they are worn beyond further usefulness only a very small proportion remains to go to the scrap pile. As compared with solid chilled iron cones, the saving in this one item alone amounts, we are informed, to a very considerable economy. The lower body, bottom plate, and driving pulley are made in best cast iron, as this material is amply strong for these parts, but in the case of the top shell, spider hopper and driving gears, which have to stand the strains of crushing, Hadfield's best toughened cast steel is used. The arms of the spider and the upper surface of the inclined diaphragm are protected from the cutting action of the stone by means of renewable covers of "Era" manganese steel. All parts are made interchangeable.



Hadfield Rock and Ore Crusher.

MINING INCORPORATIONS.

ONTARIO.

The Cobalt Portage Mines, Limited. Capital, $1,000,000, divided into one million shares of one dollar each. Head office, Toronto. Provisional directors: John Lewis, Frederick Watt, and Joseph John Hubbard, all of Toronto.

The Nipissing Power Company, Limited. Capital, $100,000, divided into one thousand shares of one hundred dollars each. Head office, Toronto, Ont. Provisional directors: Allice Scott, Ewart Reginald Lynch and James Philip Crawford, all of Toronto.

The Cobalt Annex Silver Mines, Limited. Capital, $500,000, divided into five hundred thousand shares of one dollar each. Head office, Haileybury, Ont. Provisional directors, Albert Thomas Budd, Gordon M. Murdo Petrie and Frank Pottage, all of Toronto.

The Forest Reserve Mining Company, Limited. Capital, $100,000, divided into one hundred thousand shares of one dollar each. Head office, Toronto, Ont. Provisional directors: Frank Pottage, Robert Francis Wilks, and Percival John Montague, all of Toronto.

The New York Cobalt Silver Mines, Limited. Capital, $1,000,000, divided into one million shares of one dollar each. Head office, Toronto, Ont. Provisional directors: John Lewis, William Hogen, Frederick Watt, Joseph John Hubbard and Harry Sidney Pritchard, all of Toronto.

The Lorrain Mining Company, Limited. Capital, $400,-$500,000, divided into five hundred thousand shares of one dollar each. Head office, Toronto Ont. Provisional directors: John Douglas, Casimir Stanislaus Gzowski, James Atwood, George Laird and Joseph Atkins Daggett, all of Toronto.

The Green-Meehan Mining Company, Limited. Capital, $2,500,000, divided into five hundred thousand shares of five dollars each. Provisional directors: Charles Wesley Kerr, Charles Stephen MacInnes, Christopher Charles Robinson, Margaret Glecson and Annie Eliza Lloyd, all of Toronto.

The Lorain Mining Company, Limited. Capital, $400,000, divided into four hundred thousand shares of one dollar each. Head office, Toronto Ont. Provisional directors: George Hubert Draper, Charles McEachren, Thomas Erastus Smith, Walter Blake Laidlaw, and Alfred Henry Smith, all of Toronto.

The Imperial Cobalt Silver Mining Company, Limited. Capital, $1,000,000, divided into one million shares of one dollar each. Head office, Toronto. Provisional directors, John Walter McDonald, Gertrude Eleanor Cherpaw, George Joseph Valin, Eva Lena Bradley and Thomas Brown, all of Toronto.

The Cobalt Smiley Mining Company, Limited. Capital, $40,000, divided into forty thousand shares of one dollar each. Head office, Toronto, Ont. Provisional directors, William Ruston Percival Parker, George McPhail Clark, John Alexander McEvoy, Gordon Russell and Ethyl Mabel Lindsay, all of Toronto.

The Ontario Nickel Company, Limited. Capital, $1,000,000, divided into ten thousand shares of one hundred dollars each. Head office, Worthington, Ont. Provisional directors: Herbert Henry Dow, William L. Baker both of Midland, Michigan; Albert E. Convers and George Edward Collings, of Cleveland, Ohio.

The Manhattan Cobalt Mining Company, Limited. Capital, $100,000, divided into one hundred thousand shares of one dollar each. Head office, Toronto. Provisional directors: Joseph Wilbur Coffin, Daniel Urquhart, Alexander MacGregor, Harry Williamson Page and Basil William Essery, all of Toronto.

The Edward Cobalt Mines, Limited. Capital, $100,000, divided into one hundred thousand shares of one dollar each. Head office, Toronto, Ont. Provisional directors, William Ruston Percival Parker, George McPhail Clark, John Alexander McEvoy, Gordon Russell and Ethyl Mabel Lindsay all of Toronto.

The Empress Cobalt Silver Mining Company, Limited. Capital, $500,000, divided into five hundred thousand shares of one dollar each. Head office, Toronto, Ont. Provisional directors: John Walter McDonald, Gertrude Eleanor Cherpaw, George Joseph Valin, Thomas Brown and Margaret Cairncross, all of Toronto.

The Northern Ontario Consolidated Copper Company, Limited. Capital, $1,500,000, divided into one million five hundred thousand shares of one dollar each. Head office, Sault Ste. Marie, Ont. Provisional directors: John Niven Oldham, Charles Alexander Paul and Alexander Donald McNabb all of Sault Ste. Marie, Ont.

The Cobalt and New Ontario Prospectors, Developers and Investors, Limited. Capital, $500,000, divided into five hundred thousand shares of one dollar each. Head office, Toronto. Provisional directors: James Leith Ross, Arthur Wellesley Holmsted, Frank Hamilton Potts, and Arthur Richard Bickerstaff, all of Toronto.

The Temiskaming Mining Company, Limited. Capital, $2,500,000, divided into five hundred thousand shares of one dollar each. Head office, Toronto, Ont. Provisional directors: Charles Wesley Kerr, Charles Stephen MacInnes, Christopher Charles Robinson, Margaret Gleeson, and Annie Eliza Lloyd, all of Toronto, Ont.

The United Silver Company, Limited. Capital, $1,000,000, divided into one million shares of one dollar each. Head office, Cobalt. Provisional directors, James Edward Day, John Michael Ferguson, Edward Vincent O'Sullivan, Arthur Winlow Bixel, Arthur Day, John Joseph O'Sullivan and James Henry Hallett, all of Toronto.

The Coin Silver Mining Company, Limited. Capital, $300,000, divided into three hundred thousand shares of one dollar each. Head office, Windsor, Ont. Provisional directors, Frank Edward Schoonmaker, Elias Horning Sellers, David Lawrence Murchey, George William Rice, Frank William Droelle, all of Detroit, Michigan.

The Cobalt Monarch Mining Company, Limited. Capital, $1,000,000, divided into one million shares of one dollar each. Head office, Toronto, Ont. Provisional directors, James Francis McLaughlin, John Thomas White, William Nassau Ferguson, Andrew Wentworth Hunter and Harcourt Ferguson, all of Toronto.

The Delta Lime Company, Limited. Capital, $30,000, divided into three hundred shares of one hundred dollars each. Head office, Delta, Ont. Provisional directors: William Moore Cameron, Findlay Hugh Cameron, both of Delta; William Henry Wood, William Senkler Buell and Charles Arthur McNaughton, all of Brockville, Ont.

The Rochester-Cobalt Mines, Limited. Capital, $1,000,000, divided into one million shares of one dollar each. Head office, Cobalt, Ont. Provisional directors: Nathan Stone Scott, Franklyn Brownell Sanders, Fred. Charles Becker, Frank Hause Baer, Sampson William Parsons, Joseph Howard Van Derveer, and Frank Julius Cody, all of Cleveland, Ohio, U.S.A.

The Leitch Collieries, Limited. Head office, Ottawa, Ont. Capital, $1,000,000, divided into ten thousand shares of one hundred dollars each. Incorporators: D'Arcy Hugh MacMahon, financial agent; Arthur Abel Baylie, secretary; Edward Seybold, manufacturer; James Gibson, manufacturer; William Clark Perkins, barrister-at-law; James Goodwin Gibson, barrister-at-law, and Henry Healy Williams, accountant, all of the city of Ottawa.

BRITISH COLUMBIA.

Canadian Concentrating & Smelting Co., Ltd. Capital, $750,000, divided into 75,000 shares at ten dollars each.

The Little Valley Exploration Syndicate, Ltd. Office in England. Capital, £3,500, divided in 3,500 shares at £1 each.

The Chilliwaack Oils Company, Limited. Capital, $10,000, divided into two thousand shares of five dollars each.

The Vancouver Island Copper Company. Capital, $100,000, divided into one hundred thousand shares of one dollar each.

The Ohio Mines Development Company, Limited. Capital, $1,000,000, divided into two hundred thousand shares of five dollars each.

The Wallace Mountain Mining Company, Limited. Capital $250,000, divided into two hundred and fifty thousand shares of one dollar each.

The Skeena River Gold Creek Mining Company, Limited. Capital, $50,000, divided into one hundred thousand shares of fifty cents each.

The Five Metals Mining, Concentrating and Smelting Company, Limited. Capital, $1,000,000, divided into one million shares of one dollar each.

CATALOGUES.

The following catalogues have been received:—

Catalogue No. 31. Issued by the Jeffrey Manufacturing Company, of Columbus, Ohio, describing Jeffrey crushing and pulverizing machines.

Bulletin No. 51 D. Issued by the Sullivan Machinery Company, descriptive of the Sullivan pneumatic hammer drills for quarrying and contracting work.

Smallman's patent New Model Wire Rope Haulage Clips are described and illustrated in a pamphlet recently issued by Jas. W. Smallman, Nuneaton, England.

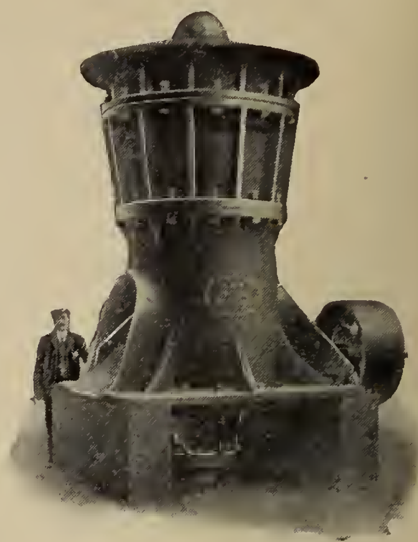
The Westinghouse Traction Brake Company, of Pittsburg, Pa., has issued a pamphlet descriptive of Straight-Line Brake Equipments, superseding that issued in July, 1904.

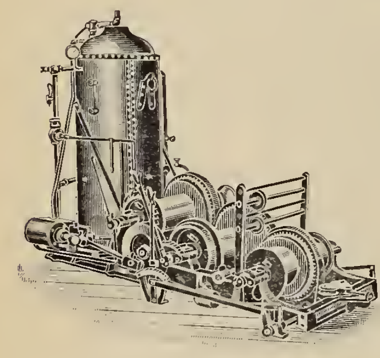
The Traylor Centrifugal Pumps, the Engelback ore-sample grinder, and Frisbie friction clutches and pulleys are described in recent publications issued by the John A. Traylor Machinery Co., of Denver, Colo.

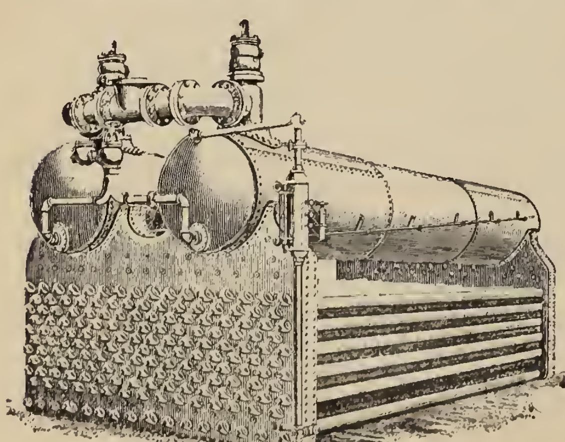
The Blaisdell System of Automatic Cyaniding Machinery is described in Catalogue F, issued by the Blaisdell Company, Los Angelos, California, U.S.A. The New York office of this company is at No. 2600 Park Row Building.

The Canadian Westinghouse Co., Ltd., of Hamilton, Ont., have issued Circular No. 1068, descriptive of the Westinghouse type "S" dynamos and motors direct current. It consists of a carefully written, illustrated, description of these well-known dynamos and motors.

Those interested in mining machinery should apply to the Allis-Chalmers Company, Milwaukee, Wisconsin, whose Canadian representatives are the Allis-Chalmers-Bullock Co., Ltd., of Montreal, for the new index just issued. This gives the titles of nearly one hundred useful descriptive pamphlets, issued by the company's department of publicity.







DOMINION OF CANADA

SYNOPSIS OF CANADIAN NORTH-WEST MINING REGULATIONS.

COAL—Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of 10 cents per ton of 2,000 pounds shall be collected on the gross output.

A person 18 years of age or over having discovered mineral in place, may locate a claim 1,500 feet x 1,500 feet.

The fee for recording a claim is $5.

At least $100 must be expended on the claim each year, or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey, made, and upon complying with other requirements, purchase the land at $1 an acre.

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Placer mining claims generally are 100 feet square ; entry fee $5, renewable yearly

A free miner may obtain two leases to dredge for gold of five miles each for a term of twenty years, renewable at the discretion of the Minister of the Interior.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles. Rental $10 per annum for each mile of river leased. Royalty at the rate of 2½ per cent. collected on the output after it exceeds $10,000.

W. W. CORY,

Deputy of the Minister of the Interior.

DAN'L SMITH, President.

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25th YEAR OF PUBLICATION

The Canadian Mining Review

Established 1882

THE OLDEST AND ONLY OFFICIAL MINING JOURNAL PUBLISHED IN CANADA.

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Advertising rates on application.
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Charles A. Bramble.

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H. W. Hixon, Victoria Mines, Sudbury.

BRITISH COLUMBIA:
Arthur Wheeling, Jr., Vancouver.

CONTENTS.

In his speech from the throne His Honour, Lieutenant-Governor Clark of Ontario, made the following reference to Ontario mining:—

The great value of the mineral deposits in the Cobalt district is becoming more and more evident and the future is full of promise both to the investor in mining properties and the people of the Province. The rights of the Province in these deposits have been kept steadily in view by my Ministers, and accordingly a measure providing for the taxation of mining properties will be submitted to you for consideration. I think it well to draw to your attention the fact that a tendency to hasty and reckless investment and speculation is abroad, and, it is to be hoped, will be kept in check by the good sense of our people.

The report of the Berry Creek Mining Company, Limited, of Victoria, B.C., for 1906, has been made public. This mine is situated in Cassiar Mining Division, British Columbia, reached by way of Wrangel, Alaska, and Telegraph Creek, B.C.

This new district was made famous in the '70s by the rush to Cassiar, when Dease, Thibert and McDame Creeks yielded $5,000,000 in placer gold. The British Columbia Mining Company has 10 hydraulic leases, 8,000 acres in all, fronting on Thibert Creek, 1,500 feet. From previous mining operations it had been learned that the average values of the ground since the company came into existence has been about 9¾ cents of gold to the cubic yard, from the top gravel, but when the bottom gravel was washed with the top gravel the average has been about 13 cents a cubic yard.

The conditions of mining at the end of last season's work were considered better than at any previous time. The paystreak shows for 1,100 feet, and it is estimated that there is in sight 400,000 cubic yards of material, having a value of from $50,000 to $55,000.

The most remarkable fact about the Berry Creek deposit is the large values in platinum, osmium and iridium. These have, heretofore, been going to waste, but it is proposed to employ an expert this year to erect a plant that shall save a large percentage of the metals of the platinum group.

According to the Latchford correspondent of a Toronto paper, it is proposed to give transportation facilities to the new camp that will no doubt be developed this spring upon the Lady Evelyn River, through a line of steamers that is to run from Latchford with certain breaks to Sucker Gut. This would be very nice for Latchford if it should turn out to be feasible.

We have spent the better part of a summer upon these waters, and we are of the opinion that a line of steamers between Latchford and Lady Evelyn will not run for some years, if ever. It is hard work to take a canoe either up, or down, many of the rapids of the Montreal River. There are the Pork Rapids, at the head of Bay Lake, and then Mattawabika Falls, which, although not so high as Niagara, would be too formidable for a steamer to negotiate, and we hardly think it would pay to build locks as suggested, seeing that the river in so many places is hardly deep enough to carry a canoe. The way to take freight into the new camp would seem to be as follows: A line of small steamers at the head of the north-eastern arm of Timagami to Stoney Portage at the north end of the lake. Here a tramway could be installed and a small light draft steamer could carry the freight across Diamond Lake, whence a road or tramway, of about one mile and a half in length, would land cargoes at Lady Evelyn River at the very head of Sucker Gut.

SUMMARY REPORT OF THE GEOLOGICAL SURVEY FOR 1906.

The issue of the Summary Report of the Geological Survey Department for the calendar year 1906 within two weeks of the close of the year is a matter of congratulation to the Hon. Mr. Templeman and to all concerned in the production of the report.

The value of this publication has been greatly enhanced by the insertion of a concise table of contents and an extended index by the use of which any reference to the mass of information contained in the report is easily found.

The report contains the Directors' statements regarding the work and administration of the Department, prominence being given to the efforts being made to increase the efficiency of the department, especially in regard to the early publication of the information collected by the different field parties; and attention is drawn to the great increase in the value of the mineral production of the Dominion during the past twenty years, from $10,221,000 in 1886 to $63,574,000 in 1905. During this period the aids towards mining given by the Dominion government as appropriations to the Geological Survey and the Mines Branch of the Department of the Interior have only increased from $115,055 to $173,555. The necessity of an increase of trained geologists to the staff is pointed out and the best method of procuring such officers is suggested.

A concise statement is given of the progress in the mining industries of the Dominion during 1906 which shows a healthy state of development throughout, owing to the enhanced prices of the metals and to the more economical methods of mining and smelting. The second part of the report deals with the work of the field parties under different officers of the department. These include the following:

Messrs. McConnell, Keele, Maclaren and O'Farrell engaged in the estimation of the value and volume of the Yukon gold-bearing gravels. Mr. Cairnes in examination of the mineral deposits of southern Yukon. Mr. LeRoy on the geology and economic minerals of the southern part of British Columbia along the Pacific coast. Mr. Leach on the important coal and copper areas of the Bulkley Valley, Skeena River. Mr. McConnell on a geological investigation of the Similkameen Valley in southern British Columbia. Messrs. Brock, Young and Boyd on an extensive study of Rossland camp. Mr. Dowling on the northern extension of the valuable coal beds in the Rocky Mountains. Dr. Chalmers and Prof. Macoun on the geology and soil along the line of the Grand Trunk Pacific railway in Saskatchewan and Alberta. Mr. Denis on the coal, oil and gas resources of Alberta and British Columbia. Messrs. McInnes and O'Sullivan on the geology and natural resources of the country on the proposed line of railway to Churchill on Hudson Bay. Mr. Ingall on the copper deposits of eastern Canada. Messrs. Collins and Wilson on portions of the country along the line of the National Transcontinental Railway in northern Ontario and Quebec. Dr. Bell on the Cobalt silver district. Dr. Barlow on the country east of Lake Timiskaming. Messrs. Johnston and Ellis on surveys in New Brunswick, and Messrs. Fletcher and Faribault on surveys in Nova Scotia.

These various reports, all of which are stuffed with facts, and many with information quite lately obtained, are condensed into one hundred and fifty-one pages and should go far to satisfying the mining community of all parts of the Dominion.

OUR CHIEF GEOLOGIST.

It is with much pleasure that we note that one of our best known geologists, a man who has been in the firing line for half a century, Dr. Robert Bell, F.R.S., Chief Geologist of the Canadian Survey, has been awarded the Cullom medal for the year 1906. The medal is given by the American Geographical Society, and this is the first time it has been awarded to any other than an American citizen.

The prize is a magnificent gold medallion, purchased out of monies left by the late Gen. T. W. Cullom of the United States Army. His will directs that the prize be given annually to such as distinguish themselves by remarkable geographical discoveries, or by their labors in the advancement of geographical science. When of equal merit, citizens of the United States were to have the preference. It speaks well for the honesty and straightforwardness of the Council, that the necessary two-thirds vote was received by a Canadian geologist.

The American Geographical Society's headquarters are in New York. They occupy a very fine and commodious building on 81st street, in which are stored the Society's large and valuable library, collections of maps, charts, etc. The Society was incorporated in 1852, or fifty-five years ago, and it has always been the principal geographical society of the great Republic. It commenced, immediately, the publication of its monthly Journal, the name of which was changed at the end of fifty years to the Bulletin, which is one of the leading geographical periodicals of the world. The Hon. Charles P. Daly, LL.D., Chief Justice of the Court of Common Pleas of New York, and a devoted geographer, was continuously president of the society from 1864 till his death in September, 1899, a period of thirty-five years.

The American Geographical Society, in awarding the Cullom Gold Medal to Dr. Bell, has conferred on him a truly substantial honor, of which he may, indeed, be proud, but this is not the only conspicuous honor for geographical work which came to Dr. Bell in 1906. Earlier in the year, the Patron's Gold Medal, the chief prize of the other great geographical body of the world, namely, the Royal Geographical Society, was awarded to him by the unanimous vote of its council, and with the cordial approval of King Edward, who pays for the medal and also takes a great interest in its award and in the work of the society in general. At one of its meetings which he attended recently, upon the conclusion of the lecture of the evening, he reviewed the subject which had been treated of and moved a vote of thanks to the lecturer.

The Patron's or King's Medal, a beautiful work of art was founded when the society was first established, in 1830. Some of its recipients in the earlier days were Endersley, Burns, Chesney, Carl Ritter, Fitzroy, and later Sir George Nares, for geographical services in various parts of the world. Among those who have won the Patron's Medal for their explorations and surveys in North America were Thos. Simpson, Dr. Rae, Captain Back, John Ross, Captain Palliser, Sir Robert McClure and Sir Leopold McClintock. This medal or other awards of the Royal Geographical Society have been bestowed upon the more noted African explorers, such as Dr. Livingston, Captains Speke, Grant and Burton, Sir Samuel Baker and Sir Henry M. Stanley.

Dr. Bell has been fortunate in his opportunities for making extensive surveys of two kinds, the work having been done for the Government of old Canada, and since 1867 for the Dominion Government. The geographical part was done as being essential to the geological, which was the principal object. It is well known that the former has been much appreciated for many years, wherever geography is studied, but the latter has really been the more important service to Canada from a utilitarian or economic point of view, and it will be found to be of the highest value as the information acquired comes to be more and more needed in the progress of mining and practical geology in the Dominion.

TINSTONE IN CANADA.

Tinstone has at last been discovered in a solid vein in Canada. Samples were received at the end of last month by the Geological Survey from Mr. Harry Piers, curator of the provincial museum, at Halifax, and they proved on being assayed to be cassiterite, the most valuable of tin ores, containing 78 per cent. of tin and 22 per cent. oxygen. The discovery was made by Mr. John Keddy, at Lake Ramsay, on John Reeve's farm, three miles west of New Ross, Lunenburg County, N.S. The ore is found in semi-crystalline forms disseminated through a vein of decomposed, kaolinized pegmatite in granite.

As early as 1868 tin ore is reported by Prof. How to have been found in Nova Scotia in granite at Tangier and Shelburne, and latterly it has also been found in granite drift at Tangier and Country Harbour, and in the tailings at Malaga gold district. Still the granite rocks which form the backbone of the peninsula of Nova Scotia have always been regarded as barren of minerals of economic value by the prospector.

In 1903, Mr. E. R. Faribault, of the Geological Survey, examined geologically the New Ross region, and reported in the Summary Report for that year, the occurrence of ores of molybdenite, zinc, iron, manganese, copper, lead and silver, and other less important minerals, and he recommended the locality as a promising field for prospecting. In the Summary Report for 1906 a reference is again made to the ore-bearing character of the granites of that region and to the rumor of tin ore having been found at Lake Ramsay. Specimens brought then from that locality were examined for tin, but they only proved to be zinc blende, a mineral which much resembles cassiterite. The vein has only been opened 12 feet in depth and it requires to be developed considerably more to prove the economic value of the deposits. Still the fact is established that the granites of Nova Scotia contain valuable minerals, and chief amongst them is tinstone. More exploratory work should be done in that region by panning for tinstone along the streams and developing the numerous pegmatite veins which cut the granite. In the reports of the Geological Survey tin ore is reported to have been found in drift at several places in Canada. It was found in New Brunswick on the Pokiok river, York county; in Quebec, on the sixth lot of the eleventh range of Whitton, Compton county; and in the gneiss of Buckingham, Labelle county; in Ontario in minute quantity at Sudbury, and the Vermillion mine, in the county of Denison, district of Algoma; in British Columbia in a three feet vein of pegmatite cutting granite near Osoyoos lake, also in Cariboo and Boundary Creek districts; and in the Yukon in several tributaries of the Klondike river, but so far, most frequently in Bonanza, Hunker and Sulphur creeks, where it occurs as stream tin in smooth rounded pebbles up to two inches in diameter, which remain with the gold in the sluice boxes, on account of their weight. The discovery of tinstone in the Laurentian rocks of Greenland constitutes a claim to attention in the fundamental strata of Baffinland where commercially valuable deposits may be expected.

Tinstone is a rare mineral all the world over, and has been found in paying quantities only in very few places, and generally in pegmatite veins in the granite. The world's output of tin in 1905 was 92,607 tons, produced by only six localities: the Malay peninsula producing 58,547 tons, or 60 per cent. of the whole. Bolivia, 12,500 tons, Billiton and Banka Islands in the Dutch East Indies, 12,615; Australia, 5,028, and England, 3,857 tons. In the United States tin ore was found in several states, including Maine, New Hampshire and Massachusetts, where it occurs in granite much similar to that of Nova Scotia, but not in paying quantities. No tin was produced in the United States before 1903; in that year nineteen tons of high grade concentrates were extracted from South Carolina and shipped to England; in 1904 about 142 tons of concentrates from South Carolina, South Dakota and Alaska were shipped to England, but no production is reported for 1905.

The price of tin has increased greatly during the last few years, and as the demand is greater than the supply it will certainly keep on increasing. In 1905 the price per pound increased from twenty-nine cents to thirty-five cents; in April, 1906, it reached 38.6 cents, and at present it is forty-two cents. The high price of tin is naturally stimulating developments in all parts of the world, especially in Australia and Bolivia. The cost of production has increased in the Malay peninsula on account of the exhaustion of the richer and more easily worked alluvial deposits, and also on account of the rise in wages.

Mr. Faribault will be in Nova Scotia again next summer to complete the geological survey of the gold-bearing and granite rocks lying to the west of Halifax in Lunenburg County, and will devote some time to a study of the mode of occurrence of the mineral veins at New Ross, so as to assist if possible in the development of this promising new district.

THE SOUTHERN YUKON.

Until recently it has been generally supposed that the mineral wealth of the Yukon existed entirely in its placer deposits, and as these are mostly in the northern part of the territory, the southern part was considered of little value. The days of the individual placer miners appears to be almost a thing of the past, as none of the fabulously rich deposits such as caused the early Klondike excitements have recently been found, and the work of washing the sands and gravels is now chiefly carried on by large concerns, so the life of the Yukon, to some, appeared to be measured by the life of the gold sands to the north. However, quartz mining has recently become of such importance and promise as to practically dispel this former idea.

To reach this country the usual route is to go by boat from Vancouver or Seattle to Skagway, Alaska, a distance of about 865 or 1,000 miles, respectively, thence via the W. P. and Y. Railway to Whitehorse, Yukon, a distance of 111 miles. From here steamers run down the river to Dawson, about 460 miles.

A few years ago a number of copper claims were staked just west of Whitehorse and some very encouraging development work was accomplished, but for a number of reasons the camp has been, until this last season, practically at a standstill. A few trial shipments of about ten tons of ore were made. Three such samples from the Copper King gave returns of 46 per cent., 31 per cent. and 29 per cent. copper, and there appears to be plenty such ore. This last season, Byron N. White, of Spokane, commenced work on the "Pueblo" and by surface stripping uncovered a body of almost solid ore about 270 by 250 feet, and a shaft was sunk in one place over 100 feet, and neither wall had at this time yet been found. The ore is hematite iron strongly impregnated with copper. The whole deposit seen would average at least 4 per cent. copper, and carries some gold values, and by hand sorting very high grade shipments could be made. The contact along which the copper properties are located can be traced over fourteen miles, and is mineralized throughout the entire distance.

With this exception no quartz mining, except a few assessments done by prospectors in different places, had been done in this southern Yukon until about a year ago this last summer, when Col. J. H. Conrad commenced work on a number of properties in the Windy Arm district, which is along the railway, and about forty miles south of Whitehorse.

Since then considerable development work has been done on a number of properties both by the Conrad Consolidated and the Anglo-American companies. The ores consist chiefly of high grade silver minerals and gold in quartz veins, which are in true fissures, and vary from a few inches in width to over twenty feet. Argentiferous galena is the chief mineral, often associated with rich silver minerals, such as argentite, ruby silver, and stephtanite, and accompanied by pyrite and arsenopyrite.

The Conrad Consolidated has three Riblet aerial tramways in operation for carrying the ores of the different properties to the shores of Windy Arm, the longest being 18,697 feet in length, with its upper terminal 3,469 feet above the lower, cost over $90,000 to install. The others are much shorter.

Some shipments of ore have been made, but these were mostly trial shipments. The properties are as yet in the prospect stage, but for the amount of work done look very promising.

The success of the Windy Arm properties encouraged prospectors to prospect more carefully this season, with the result that a number of valuable finds have been made. About the middle of June quartz carrying free gold and telluride minerals was found between the Watson and Wheaton rivers, about eighteen miles southwest of Robinson Siding. These quart veins were traced in a belt about two miles wide for about twenty miles in a southeasterly direction, and, over seven hundred locations were made. The quartz is quite well mineralized in places, carrying gold and silver values chiefly. However, no work has been done as yet to see what values the veins really carry. The telluride ores from the original discovery on Gold Hill assayed into thousands of dollars per ton, but only a small amount of this was found. The average surface assays which were made in the district were, however, encouraging.

A large body of stibnite carrying mercury was also discovered towards the end of the season, to the west of the other properties.

So considering that there were only a few men in the country and these were only prospecting a very short time, the results go to show over what wide areas the valuable ore deposits of the Yukon are distributed.

Added to this there is plenty of coal in the district. Quite an extensive basin of anthracite coal lies just to the south of the Whitehorse copper deposits, and is easily accessible from the railway. Also coal is being mined down the river north from Whitehorse in different places, and will probably be found much closer to Whitehorse. The samples taken from Tantalus and Five Fingers mines gives in the laboratory a good firm coherent coke. So that a smelter at Whitehorse, to treat the copper ores there, is one of the probabilities in the very near future, as there is plenty of water power in the vicinity.

OUR MINING INDUSTRY IN 1906.

The Director of the Geological Survey has introduced into his summary report for 1906 a new feature which will appeal to all those interested in the mining industry of this country. In a few words he sums up the principal items of the mineral production and shows that the mining industry has never yet been in so healthy a condition. He writes, "It can be said without fear of exaggeration that the condition of the mining industry in Canada in 1906 has been one of large prosperity, that it has, in fact, achieved greater progress and given bigger returns than during any previous year on record. In the year 1905 the total mineral output reached almost $70,000,000, as compared with but a little over $60,000,000 in 1904, and while actual figures of production are not yet available for 1906, the activity evidenced in both the metalliferous and non-metalliferous mining will, no doubt, result in another large increase being shown. There has been during the year an active demand for nearly all mining products, and the higher prices realized, especially for the metals and their ores, has not only helped to increase the actual output, but have stimulated development and prospecting throughout the country.

Metallic.—The increase in prices of metals during 1906 is distinctly shown by the following quotations. The average price of the metals for 1905 was as follows: Silver, 60.35 cents per ounce; copper, 15.59 cents per pound; lead, 4.7 cents per pound; spelter, 5.82 cents per pound; nickel, 40 cents per pound. During 1906 the prices of all these metals had increased, and in December, 1906, the quotations were as follows: Silver over 70 cents per ounce; copper, over 22 cents per pound; lead, 5.75 cents per pound; spelter, 6.4 cents per pound; and nickel from 45 to 50 cents per pound.

Nickel.—The nickel-copper mines at Sudbury have been actively worked throughout the year and will show an increased output. Electric power has been introduced and the general efficiency of the works greatly improved.

Copper.—The actual output of copper in eastern Canada, outside of the metal obtained from the nickel ores above mentioned, is comparatively small, but a great deal of work has been done during the year in the exploration and development of copper properties.

British Columbia is now Canada's great copper-producing province and more particularly the great bodies of low grade, but easily mined, ores of the Boundary district. The shipments from this district during ten months of 1906 are estimated at close on a million tons or greater than the total output of 1905. The smelting capacity of three furnaces in the district was considerably increased during the year. Dividends were declared by one company aggregating $1,215,000.

The copper mines of the Coast district in this province have been actively worked during the year, as were also in the ores of the Rossland district, which are further mentioned under the heading "Gold."

Gold.—The gold output in Canada has been showing a yearly decrease since 1900 due to a regular falling off in the Yukon placer production, and this decrease has, in all probability, continued in 1906. In eastern Canada the output has never been large, but Nova Scotia seems to make a better showing in 1906 than in the immediately preceding years. In British Columbia the gold production has shown a slow but steady increase which has to some extent counterbalanced the decrease in the Yukon output. In Rossland an important amalgamation of interests took place in the early part of the year. The War Eagle and Centre Star mines, the smelting works of Trail, with the St. Eugene silver-lead mines of East Kootenay, and other interests, were united under one management known as the Consolidated Mining and Smelting Company of Canada. The consolidation is one which will, no doubt, tend to much greater stability in the mining industry.

The discovery of new ore shoots in the Centre Star and other mines, the payment of dividends by the Le Roi, the Le Roi No. 2, and the Consolidated Mining and Smelting Company, and the encouraging detailed geological work done by the Geological Survey under Mr. Brock, have all tended to put new life into the district and a bright future is looked forward to. The total ore shipments for 1906 may possibly not exceed or even equal those of 1905 owing to the unfortunate strike of coal miners at Fernie having caused the smelters to close down for some months in the latter part of the year for want of coke.

In Cariboo several properties, including that of the celebrated Consolidated Cariboo Hydraulic Mining Company, were acquired by the Guggenheim Exploration Company, and a large investment of capital is being made in the construction of many miles of new ditches, which will supply a more regular and larger supply of water for the working of the huge areas of gold-bearing gravels this company possesses.

The Atlin placer deposits were worked about as usual, although a shortage of water had to be contended with.

The gold output of the Yukon will again apparently show a decrease. Official figures are not yet available, but from current reports apparently not more than $6,000,000 is to be expected this year. In this district the large corporations are absorbing the smaller operators and the Guggenheim Exploration Company under the name of the Yukon Consolidated Gold Fields Company has entered the field buying up numerous claims. The company has already commenced the construction of ditches and flumes to provide water for operating their claims. Other large work are to be undertaken, such as the construction of reservoirs, a power plant, etc., and altogether a large number of men will be employed this winter.

Iron.—The iron industry has been active throughout the year, a good demand for all classes of iron products having been experienced and the iron furnaces have been operated probably more extensively than ever before. A new furnace plant is in course of erection at Port Arthur intended to utilize the ores of the Atikokan areas. The output of pig is likely to be larger than in 1905, and would probably have been still greater but for an unfortunate dispute between the Dominion Iron and Steel Company and the Dominion Coal Company in November regarding their coal contract.

Lead and Silver.—The argentiferous galenas of the Kootenay districts are again being worked on a large scale, the East Kootenay mines, St. Eugene and others, being large shippers during 1906.

The Cobalt district of Ontario has attracted world wide attention during the year and is rapidly becoming an important silver producing district.

Zinc.—The concentrating of zinc ores in British Columbia has continued with considerable success. The large zinc smelter at Frank, Alta., was sufficiently advanced for the first metal to be turned out in June. It is understood, however, that some further changes and improvements were found necessary before regular smelting could be undertaken.

Non-metallic.—Amongst the non-metallic class of minerals mined in Canada, the more important are mica, chromite, coal, corundum, gypsum, mica natural gas, petroleum and salt, besides the structural materials including the clay products, stone and lime and cement. The mining of all these products and others of lesser importance has actively progressed during the year. The coal mining industry especially has made good progress in the various fields exploited, Nova Scotia, Alberta and Saskatchewan and the Crowsnest Pass and Vancouver Island fields of British Columbia. In Alberta a rapidly growing population has created such a demand for coal that new mines are yearly opened up and a much larger output made. Nearly one-half the coal mined at the Crowsnest Pass is converted into coke to supply the rapidly growing demands of the smelting industry in British Columbia and for export. Labor difficulties have interfered to some extent with the operations at Fernie and at Lethbridge, the latter causing a shortage of coal at certain points in Saskatchewan which threatened to become serious. These difficulties have, however, been happily settled before the close of the year and no doubt in time to avoid any further serious trouble.

The asbestos mining in the eastern townships of Quebec has been particularly active during the year, prices have been good and a large increase in mill capacity to handle the mineral is contemplated.

The chromite ores of this district have also been mined about as usual.

Gypsum mining in Nova Scotia and New Brunswick and to a lesser extent in Ontario and in Manitoba has been carried on with increased output. Higher prices have also been obtained in this industry.

The corundum of Ontario finds a ready market; mica has been in good demand and at higher prices, while natural gas, petroleum and salt industries of the Ontario peninsula have been worked as usual.

In the structural material class the production of clay products such as bricks, tiles, etc., stone and lime, has to keep pace with the growth of the population. The increased use of cement in all kinds of structural work such as buildings, sidewalks, and roadwork, bridges and monolithic work, etc., has caused a great demand for this product and a largely increased output is being made.

CONCENTRATION.*

Since the world became highly civilized, there have been eras, or ages, when some one great industry has flourished to a much greater extent than the rest during that period, such conditions lasting, perhaps, for several decades and even centuries. The present age might appropriately be called the age of mining. At no previous time in the history of the world has the mining industry taken such a strong hold on the people as at present. Mining in nearly every civilized country has forged to the front with great rapidity. New discoveries are being made every day, and new concentration, or reduction, plants installed.

Canada, as we are all convinced now, is a country of great mining possibilities. Events are transpiring from day to day which demonstrate, as Dr. Adams has pointed out, that we have scratched or prospected only a very small percentage of the great territory allotted to us for exploration, and that we may reasonably expect such great and almost bewildering discoveries, as the world has never yet witnessed. But, right here, another aspect of the subject presents itself, and this may be best put into the form of the following questions. Are we aware that many ore deposits, of various natures, whose existence has been known to us for years, have not been developed, nor has there been any attempt made to make them economically useful? Do we realize that with the progress of technical science we are able, to-day, to treat ores more successfully than ten or twenty years ago? That we now can make mines pay, which could not be put on a paying basis years ago, on account of the lack of knowledge of proper methods of treatment?

Gentlemen, it would appear from these questions that I find fault with the craving of the general public for something new, before they have taken advantage, fully, of these dormant things lying at our threshold waiting utilization! No; far from it. New mineral discoveries are needed to draw the attention of foreigners, and of foreign capital to this country—Canada in the first place needs a denser population, and, so far as I can judge, we need more foreign capital with which to develop our resources. But it often happens, that just such capital, originally intended for investment in new discoveries, has, for some reason or another, been applied to the development of mineral resources of this country, known for some time, but which on account of expensive methods of separation could not in the past be made to pay.

Here then, logically, another question arises: What constitutes the success of a mine? What are the essential factors which make up the successful mining venture? Gentlemen, to answer this question would require a long dissertation on a subject which lies beyond the scope of this paper. First and foremost, there is required a study of the geology of the ore deposits—a branch of science which has been greatly developed during recent years. To cite only one example of how this enters into practice; it may be remarked that thousands of dollars expended in the fruitless prospecting of twenty years ago, would have been saved, if there had then been the knowledge of secondary enrichment that there is to-day. Next comes the matter of the tonnage, and in the case of metalliferous ores, the assay of the ore developed. Of great importance are the conditions governing the extraction of the ore, and the cost of mining. And last, but not least, the question of the treatment of the ore—its economic separation from the accompanying gangue material. It is upon this latter subject that I should like to say a few words to you, gentlemen, especially to the younger members of my audience, and I feel confident that you, after careful consideration, will find my remarks, based as they are on personal observation in the field, to be not far from the mark.

The mining engineer of to-day requires not only a broad knowledge of the geological conditions which govern the mineral deposits, not only a knowledge of the ways and means of getting out the ore, but he requires also a deep knowledge of the problems of separation. How many mines have been doomed to failure through the absence of just such knowledge? The profession of mining engineering presupposes, nowadays, a very broad knowledge of the principles which govern modern ore separation. Twenty years ago we may say that ore separation was simply in its infancy; a time when it was believed that simply cobbing the ore, or putting it through a crusher and treating it by the wet process, was perhaps enough for so called rough treatment, and when no further utilization of the residue was deemed necessary. But, to-day, with the great advance in technical science, with progress in all branches of industry, these old processes are found insufficient, and to our great

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* Address delivered before the Mining Society of McGill University by Mr. Fritz Cirkel, M.E., Montreal.

satisfaction we find that mining engineers have not been idle in extending and improving the processes in vogue, in fact, old-fashioned separation methods have been succeeded by others that make it possible for a mine to pay dividends which could not have been worked at a profit by old methods.

But, gentlemen, we must not stop here. We must not think there has been such progress that we may now treat all kinds of ore with success. On the contrary, new ores of complex composition, are found each day, and which require special treatment, though the principles involved may be in all cases identical.

Take gold, for instance, We all know that some twenty years ago the only way of extracting gold from its matrix was by the well known amalgamation process, which was, with here and there slight variations, applied to all free milling gold ores. We remember, also, that twenty years ago great excitement was caused by the invention of the cyanide process. Now, from the success this process has attained treating Transvaal ores, as well as those of California, it would seem that nearly all gold ores could be amenable to this process with slight variations. But this we know is not the case. A further development was registered by the application of the Pellatin-Clerici process, an electric process, for which it was claimed, that all gold occurring even in a very fine state of division could be extracted. Yet, although this process was successfully applied to a number of ores, still there are gold ores which do not seem to be attacked successfully by any process in vogue. I have a case in mind, where ores which contain the gold in a very fine state of division, were treated with this process, and the result was that fully 45 per cent. of all the gold was lost. Another case, which will illustrate the necessity of continuous experimentation with one's ore, is one which came under my attention some eight years ago, in the State of Washington. This mine when I made the examination, had, approximately, 100,000 tons of gold ore in sight, averaging eleven dollars in gold to the ton. A mill was built for the treatment of the ore at an expense of $60,000, but, although great efforts were made to bring the enterprise to a successful issue, it was doomed to failure, owing to the impossibility of getting a satisfactory extraction of the values. This mine, although having a very large tonnage of ore in sight, has been lying idle ever since. Here, gentlemen, is an example of a case where ingenuity can make its mark; here is a case which demonstrates that we have not yet solved the problem of gold extraction in all cases, and it is for the engineer, and for the chemist to work hand in hand for the discovery of such treatment as may deal with ores in which the gold is in an extremely fine state of division. Here, is a case where a fortune awaits the engineer or chemist, who will solve an intricate problem of gold extraction.

I will deal, now, with another ore, which is the mainstay, the backbone and foundation of the wealth of a nation; iron. You know that we find iron deposits through the Laurentian formation. A number of deposits were worked some thirty or forty years ago, and although the mines offered great inducements as regards tonnage in sight, the operations were not successful. What was the cause? Was it the composition of the ore, which prevented it from being used successfully in the furnace? No, it was, simply, the lack of proper separation of the ore from the gangue. But it is with satisfaction we find that since that time processes have been invented which facilitate the concentration and handling of such ores. Magnetic ores, in nearly all cases, are more or less mixed with the rock of the containing formation, and it would be an immense task to separate the ore from the gangue by hand. However, magnetic concentration comes to our aid, and ores which have only a percentage of 23 per cent. can be made use of by concentration. I may add that in the great concentration plants in the Adirondacks, magnetic concentration is in vogue, and the mines, through this process alone, have been made an unqualified success, and put on a paying basis.

From an examination of the iron ore deposits in Ottawa County, I am convinced that our magnetic mines can be put on a paying basis, by just such a system of magnetic concentration, and it is not unlikely that an American firm, which has been conducting diamond drill operations in some of the mines, will put up a large concentration plant, and work the mines to their full capacity.

From what I have said, gentlemen, you may easily infer that here is another case, where there is sufficient ore in sight, but where there has been no mechanical means whereby the ore might be treated, so that it was acceptable to the market. John Stuart Mill says: "To draw inferences is the great business of life."

I may quote another example of my meaning—asbestos. You know that Canada supplies the whole world with asbestos, but this would not be so were it not for the processes of separation which have been invented to extract the fibre from the gangue. The history of this mineral makes interesting reading. Mining operations in the Eastern Townships of Quebec commenced on a small scale in 1878, and in that year 50 tons were taken out for which, however, it was difficult to find a market. The quality of the fibre was excellent, and the width of the veins was everything that could be desired, from 1 inch up to 2, 3 and sometimes 4 inches. This justified the expectation that large deposits of the mineral might exist in that locality, though their true importance and value were not ascertained until several years later. Shipments of the better grades made to London created quite a sensation in the market; extensive tests and investigations were

Dr. Robert Bell, F.R.S.,
Chief Geologist.

made, and the result was that the high value of this mineral on account of its exceptional qualities for spinning purposes was soon established, and the race for the acquisition of additional areas likely to contain the valuable mineral began. The land was considered practically of very little value for agricultural or any other purpose, and mining operations were rapidly extended.

For the next ten years we witness a rapid development of the industry. The mines are worked on a large scale, while the prospector is still busy exploring for the mineral in the surrounding mountains. Villages spring up like mushrooms, in a country which is physically speaking, one of the roughest. The population, comprising before the begining of mining operations, only a few scattered families, increases to several thousands, and the whole country shows all the evidences of industrial activity and prosperity.

But it was soon discovered that the primitive methods of hand extraction were faulty, inadequate and expensive, especially as far as the lower grades were concerned. As a matter of fact, under prevailing price conditions, only those mines which were working on richer ground, and had a large percentage of crude asbestos, had a chance to live and carry on operations with a proflt. The natural outcome of this condition was obvious; many mines producing only a very small percentage of the higher grades were forced to shut down, and this, together with serious difficulties accentuated by overproduction and a consequent fall in prices, caused the industry to receive a severe set back in the middle of the nineties. For some years the industry languished, all retiring save those who would not be discouraged, no matter what should happen.

However, the mechanical ingenuity of those engaged in the mines, and of those having the development of the industry at heart, came to the rescue; handcobbing of the lower classes of asbestos gave way gradually to mechanical treatment, and this method, in the course of years, was so successfully and effectively worked out that, to-day, we find every mine in the district with a complete milling and fiberizing plant. By this process, all the smaller fibre, which in the earlier years was left in the rock, and thrown on the dump, is saved, and as new uses for this short material sprang up, the life of a mine was prolonged and its management attended with less difficulty.

As a result of these innovations, 16 mills with a capacity of 3,500 tons of asbestos rock per day, are operating in the district, and if reports prove true, the capacity of the mines and mills will be largely increased during the present year.

The asbestos industry is a striking example of what human ingenuity, if applied in the right direction, may accomplish. It demonstrates that, in order to atttain success, it is necessary "To strive, to seek, to find and not to yield."

The asbestos mines of the Eastern Townships constitute one of the most prosperous industries of the Dominion of Canada, and they are of special interest to the mining and industrial world, from the fact that, in so far as now known, they represent practically the only deposits where this mineral of a quality adapted for spinning and for the finer purposes of manufacture can be mined with a profit. So great are the advantages which these mines possess, particularly as regards accessibility and the ease with which the extraction of the fibre is now accomplished in the mills that, unless fields as yet unknown and as easy of access can be discovered, the Province of Quebec will long enjoy the privilege of being the principal source of supply of asbestos, not only of the North American continent, but of the world.

I have another case in mind; graphite. Canada has been known for over 50 years to possess rich deposits of this mineral in the Laurentian formation. But what have we to show in the way of a graphite industry, in the way of development of our mines, or of concentration plants? Surely, not much up to this time. The statistics tell us the yearly production amounts to only a few thousand dollars. But there seems to be to-day a better appreciation of our graphite resources, especially by foreigners, and this, going hand in hand with great improvements in concentration will, undoubtedly, result in the establishment of a solid graphite industry.

The general public nowadays is apt too much to live under illusions of prospects of great wealth; they invest blindly in mining ventures where according to their opinion great wealth awaits them, or is, at least, bound to come by persistently putting holes in the ground. As a rule, they consider mining as a gamble, and not as a legitimate business as in any other walks of life. They flee the practical miner who offers a mine abounding in low priced ores; but they listen attentively to the promoter with his fairy tales of fabulous silver finds in the Cobalt district, who will eventually do "mining" himself—not in Cobalt but in the pockets of the public. What is the result? The resources of the lesser minerals lie dormant and are not developed. I have a case in mind where large tracts of graphite lands, with numerous outcrops of fine flake graphite could not find a buyer for years, until American capitalists took hold of them recently. They, by further exploration work, found that the ore bodies were of such large extent that now two graphite separation plants are in course of construction, and over one million dollars has thus been invested in the last two years.

It is gratifying to know that American capitalists are now taking a hand in the development of these resources. They have not been slow in recognizing the great value of these deposits; and that is not all—they have also realized the great value of concentration in making the mineral marketable, and here—I venture to say—lies the secret of success in the case of graphite mining.

I trust I may be permitted here to discuss some of the principal causes which retarded measurably the healthy progress of this industry. The graphite ores of even the same composition cannot always be treated by similar methods, on account of the different physical characteristics of the mineral occurrences. This difficulty is apparent in the case of ores containing flake graphite, as well as in those containing only dense or amorphous graphite. Both of these ores occur in some localities in gniess, but it would be futile to attempt to apply a process, which gives perhaps good results in the separation of these ores occur in some localities in gneiss, but is even more complicated, when ores containing both varieties are to be treated.

Another difficulty arises from the fact, that in some localities the gangue, accompanying the mineral, is found to change as development proceeds, and it must be said, that this is one of the principal sources of difficulties in the construction, operation and adjustment of graphite mills. The selection of one or the other method is very often based on guess work, and with very little regard to what the general "run of mine" is likely to be. When a deposit of graphite is discovered, a number of test holes are sunk, as a rule, to determine the character of the ore, or to trace the ore lode on the surface; where the ore appears to be of satisfactory quality and quantity, larger excavations are made, or a shaft is sunk, or a tunnel is run, following the trend of the ore body, and in the majority of cases, where quick returns are essential for the continuation of the enterprise, the construction of a mill for the treatment of the ore is proceeded with, based on preliminary tests with ore generally taken from chutes, which promise to deliver the bulk of the material to be treated. Very often, however, it is found in the further development of the mine, especially in the crystalline formations that the ore changes in character, both physically and mineralogically. That, for instance, an ore originally flaky turns into one that is both flaky and amorphous; that, further, the gangue with the accessory minerals change, and so on, and the result is that the mill which was originally laid out and constructed to suit a specific class of ore has now to treat an entirely different one. A series of experiments then demonstrate, that the arrangement of the apparatus and perhaps these themselves have also, to be changed, in order to meet these new conditions; sometimes an entirely new system has to be adopted, which in the majority of cases can only be done by spending a large amount of money.

The author has a case in mind, where a property was superficially tested and found to contain flake graphite in quartz. Before proceeding with the development of the mine, to determine the extent of the ore body and its character, a mill for the treatment of the ore was erected. In developing this mine, however, it was discovered, that the contents of flake diminished, and that, instead, amorphous graphite appeared. That, further, the gangue changed from quartz into pure calcite. The consequences were obvious. Change after change had to be made in the mill in order to meet new conditions arising solely out of the development of the mine, but with little success, until it seemed inadvisable to alter the existing milling process. The construction of an entirely new mill was the only remedy, but the financial resources being exhausted mill and mine were shut down.

We learn from this example, that the construction of a mill to treat the ores of a mine should only be proceeded with, when all the conditions, the character of the ore, as well as the extent of the ore body, are fully known, and this can only be attained, if the mine is developed properly, the stopes laid open, and the different ore shutes thoroughly tested as to their contents in useful and waste material. Until such is the case experiments on a large scale with the ore should be deferred, the preliminary outlay for opening up the mine is insignificant compared with the large expenditure, to say nothing of the trouble and annoyance, resulting from the premature erection of a milling plant, with a system based upon guesswork, hasty judgment, and insufficient knowledge of the conditions really existing in the mine.

Mechanical ore separation is an ancient art, but during the last ten years it has experienced some remarkable improvements. These have revolutionized the practice of ore dressing in general; it appears, probable, that there will be still further innovations, of a character not yet clearly foreseen, except by some inventors who are working on special lines. Even as recently as five years ago there were practically no methods of mechanical separation, except hand sorting, jigging and washing on tables, and magnetic separation, the last method having only a very limited application. Since then radically new processes, such as electrostatic separation, oil concentration and the flotation of minerals in certain baths have been discovered. In these ways it has become possible to separate a wide range of minerals of close specific gravity, that cannot be separated by jigging or slime washing. Similarly, it has been demonstrated, that phosphate can be separated from hornblende, the difference in specific gravity being only 0.35, further molybdenite, monazite and other rare minerls, can be separated from their gangue, which it is often difficult to do by ordinary gravity concentration. Experiments have shown that graphite may be separated electrostatically from its gangue, and it is not unlikely that such a process will be developed commercially before long. These experiments have been, to a certain degree, successful, and, it may only be a question of time and of some improvements, before a complete success is attained. It may be of interest to quote the following note from W. R. Ingalls* on general ore separation: "Probably few realize the probable extent of development, which they will experience during the next ten years, or what results may be achieved by them. It is quite certain that no single process is a universal panacea for all the difficult problems of ore treatment. For certain ores one process is best adapted; for other ores another process. For still other ores the best results may be achieved by a combination of two, or three, or even more of the special processes. This is a direction of effort, that has not yet received very much attention. It will be, however, the logical result when the design of such ore dressing plants passes out of the hands of the promoters of special processes into those of the engineer, who is retained by his clients to secure the best results."

Gentlemen, I trust that you have fully understood the purpose of my paper. I have drawn your attention to the fact that good mining engineering besides geology, mechanical engineering and surveying, requires also a thorough knowledge of the principles of ore separation. It is often asserted that in order to make this or that ore marketable, it is only necessary to write to an engineering firm, who will put up the concentration plants at a contract price. This procedure is as stupid as it is unbusiness like. Each firm has certain special machinery to sell, which might work in a satisfactory way, on a specific mineral of a certain chemical composition or physical qualities; but these machines do not give satisfaction on every ore. Generalizations on this subject are entirely impossible, and it is the engineer in charge upon whom falls the task of devising such apparatus, or of making such combinations of known apparatus as will enable him to make the best extraction of his ore. It is when face to face with cases of this kind that the mining engineer can show of what stuff he is made; whether he has fully grasped the value and applicability of general concentration principles.

Many a mining enterprise has been doomed to failure because the party at its head had no knowledge of the theory and practice of the separation and classification of ores. It is not sufficient for an engineer to know whether this rock is a granite, or that one a diorite; it is not sufficient to unearth hidden treasure and bring it to the light of day; no, in ninety out of a hundred cases, the real work and trouble begins with the preparation of the ore for the market. It is all very well to dig out silver by the bushel as they do in some of the Cobalt mines. These mines are exceptions to the rule, and they form only a very minute percentage of the working mines. Gentlemen,—and I mean specially those young fellows who are preparing for the difficult task of the mining engineer,—only a few of you will have the pleasure of becoming the leading spirit of a mining enterprise, where there is abundance of rich ore, and where there is perhaps no difficulty in marketing whatever you get out of the mine. But, I venture to say, that most of you in the course of your professional career, will have to confront other more serious problems, some of which will tax not only your knowledge of concentration but also your resourcefulness. You may be called upon some day by people who put unlimited confidence in your ability, to take your place at the head of a large mining enterprise, to answer the fundamental questions which determine the value of a property: How much will it pay? How long will it pay? And how much will it cost?

Gentlemen, I think I have already taken up too much of your time, yet in conclusion may I be permitted to say one word more: Do not neglect the study of the fundamental principles of ore separation and classification.

I trust that I have shown you in the examples I have mentioned why you should devote much of your time to these subjects. You enjoy such great facilities here in McGill University, that I should think you would find no trouble, whatsoever, in making yourselves acquainted with the subject under discussion. You have all the important machines that are used in concentration, and on which you can study at your leisure the principles involved, and in this respect, McGill is far ahead of any other institution of a similar nature. I remember that, when I was studying at the Academy at Aachen, Germany, our mining professor explained the working mechanism of various apparatus by small models, which were supposed to be true copies, and that we never had the opportunity—as you gentlemen have here in this institution—to put these to practical tests. I must congratulate you upon the splendid equipment of your mining laboratory and concentration plant; but this is simply due to the untiring efforts of Dr. Bonsall Porter.

* "Engineering and Mining Journal," 1905, to page 643.

CLAY AND THE CLAY INDUSTRY IN ONTARIO.

By W. G. M.

The more stable but more prosaic mineral industries of a country are apt to be neglected somewhat for those which appeal more strongly to men's imagination or cupidity The clay working industry, which next to agriculture, can be called the most ancient of industries, has up to the present been almost neglected by scientific workers, although during late years in Germany, the United States, and in other countries, it has been receiving more attention. Several of the States of the American Union, and other countries, now have departments devoted to the study of clay and its products. In Ontario the clay industry has grown rapidly during recent years. Brick, being cheaper than stone, is being used in modern cities in place of wood on account of fire protection purposes. As years go on, the clay industry must become proportionately more important. It is well, therefore, at this time, for Ontario to have a systematic report such as that of Mr. M. B. Baker, on "Clay and the Clay Industry," The report is now in press and will be distributed at an early date by the Bureau of Mines, Toronto.

In Part I. of his report Mr. Baker gives, in 41 pages, an account of the character, origin and modes of occurrence of clay, written in such a way as to be understood, it is believed, by persons who have had little technical training. His age classification of clays will doubtless be found very useful by manufacturers as well as having an educational value from the side of culture. Every worker's interests will be widened and his mental attainments broadened by his understanding something of the origin and relationships of the materials with which he is dealing. There is nothing in Mr. Baker's report treating of the relationships of the various shales and clays—Erie, Red Top, Leda and Saugeen—with which every clay worker in the Province has something to do, that cannot be understood by almost any one who can read English. Manufacturing difficulties will thus be avoided and a scientific knowledge will be gained which cannot be estimated in mere dollars and cents.

The 15 pages of Part II. are devoted to the manufacture of clay products. In these pages the methods of manufacture are described and practical hints are given for overcoming difficulties which are met with almost daily in manufacturing

In Part III., pages 56-112, typical shale and clay working plants are described under the heading of counties, which follow one another in alphabetical order. This part of the report will be of local interest. The clay worker who desires to gain a knowledge of the modes of occurrence of his material, will have descriptions of similar occurrences in his own county with which to compare it.

Pages 112-120 deal briefly with various industries in which clay is used as part of the raw materials.

The 71 illustrations in the report have been carefully selected to represent typical occurrences of clay and shale, to throw light on the modes of occurrence of these materials and to represent various machines and plants used in the clay industry in the Province.

Mr. Baker's work in connection with the industry has not only been of value in the preparation of this report, but he has done work, which has been highly commended by clay workers in various parts of the Province, in giving practical advice in his visits to many plants.

Three or four years ago the clay workers, first of Ontario, and now of the whole Dominion, organized a society known as the Canadian Clay Products Manufacturers, which holds an annual meeting—the last three being at Waterloo, Hamilton and Toronto respectively—at which numerous papers are read and discussions are held on various topics connected with the industry. These meetings have proved very valuable and every clay worker of the Province should join the rapidly growing membership of the society.

The statistics of the clay industry show more clearly than can otherwise be done the relative importance of clay among mineral products. In this Province the manufactures from clay have till recently represented nearly 20 per cent. of the output of our total mineral industry. In the United States clay products form nearly 10 per cent. of the very large mineral output. Moreover, it should be remembered that a high percentage of the receipts from the clay industry are expended on labor and supplies. From this point of view no mineral industry can be claimed to benefit a community or a country more than that of clay.

BRITISH COLUMBIA IN 1906.

By Arthur Wheeler, Jr., Vancouver, B.C.

The year just past has been by far the best, from the standpoint both of tonnage and value, that British Columbia has had since her advent into the list of mineral producing countries of the world.

While the figures following are only approximate, full returns not being yet available, they have been compiled by Mr. Wm. Fleet Robertson, Provincial Mineralogist, and may be taken as rather under than over the mark.

Compared with the official figures for 1905, the estimate is:—

	1906.	1905.
Gold	$6,070,000	$5,902,402
Silver	2,200,000	1,971,818
Copper	8,690,000	5,876,222
Lead	2,690,000	2,399,022
Coal	4,590,000	4,152,936
Coke	1,050,000	1,358,925
Miscellaneous	1,100,000	800,000
Totals	$26,390,000	$22,461,325

Worked out these figures mean that copper has increased in value of production 49 per cent.; lead, 13 per cent.; silver, 11.6 per cent., and gold 3 per cent. Coal production has increased 10 per cent. and miscellaneous products 13½ per cent. Coke has fallen off slightly, owing to the seven weeks' strike in the Fernie coal mines during October and November last.

This strike not only lowered the possible production of coke, and coal, but seriously affected the copper, lead and silver production, as during the strike practically all the up-country smelters either closed entirely or seriously curtailed their output.

Consequently many of the mines ceased mining and undertook repair work, and, this reduced the possible output by perhaps $5,000,000.

As can be seen from the table above the total estimated value of British Columbia mineral output last year reached the enormous total of $26,390,000, which one, taking the population of the province as only 200,000, being less than the population of the city of Seattle, the fact of the richness of this province is made more apparent.

Figuring out the per capita production of mineral, mined in British Columbia in 1906, shows that nearly $132 was produced for every man, woman and child in the province.

Tonnage.

From statistics to hand, the ore tonnage for the past year is as follows:—

	Tons.
Coast (estimated)	90,000
Boundary	1,155,138
Rossland	281,711
Slocan-Kootenay	133,299
Total	1,660,148

ATLIN.

The gold output for this district for 1906 was approximately $500,000, with every prospect for a much increased production for the coming season, due to the fact that the advent of the Guggenheim Exploration Syndicate has led to much better processes for saving the gold and on a very much larger scale than heretofore.

Pine Creek.—Work on this creek has been confined almost entirely to two companies, the Pine Creek Power Company and the Atlin Consolidated Mining Company. Both of these companies have been very successful. The former operated two pits with three giants with 7-in. nozzles in each pit. From 20 to 25 men were employed in each pit and the plan of exploding 2,000 pounds of 75 per cent. powder in one blast was adhered to with the same gratifying results as in 1905.

The Atlin Consolidated Mining Company is operating above the Pine Creek Power Co. The company did not get properly started until August, when a 70-ton Bucyrus shovel was installed. After work started in earnest $1,000 was taken out every 24 hours.

On Boulder Creek, a tributary of Pine Creek, La Societe Miniere de la Colombie Britannique realized $40,000 for the season's work.

Spruce Creek.—It is this creek that the Guggenheims intend operating. They have secured practically everything excepting the property of the Spruce Creek Power Company. They will, in all probability secure enough stock in this company to gain control and will then, according to Mrs. Rosalind Watson Young, A.M., I.M.E., to whom I am indebted for the information concerning Atlin, which appears in the current number of the B. C. Mining Exchange, put in a bedrock flume and mine the gravel by steam shovel.

A company operating on Spruce Creek called the Northern Mines, Limited, has come to grief through having two managers. Another, the Columbia Hydraulic Company, has sold out because it installed a plant without having first prospected the ground, and still another, the British Columbia Dredging Company only operated for one month and, as returns were unsatisfactory, then ceased operations.

So far dredges have proved a total failure in Atlin and only steam shovels have paid the big operators.

McKee Creek.—Work is now confined to the McKee Amalgamated and the McKee Consolidated Companies, who have control of the creek. These two companies are under one management. H. Plumbe, who has been in charge for two years, in the absence of the Hamshaw Brothers, has secured for his company about $50,000 each year. In the coming season a steam shovel and tram system are to be introduced. McKee has been a dividend producer.

Speaking of this company, Mr. Fletcher T. Hamshaw, the manager, said recently: — "The steam shovel will be operated in conjunction with the hydraulics already in operation. I will hydraulic off the top material down to within 12 feet of bedrock, and pick up the gold-bearing gravel together with four feet of soft bed rock with the steam shovel.

"The plant will consist of a Bucyrus 110-ton steam shovel, one mile of railroad and switches, 30 six-cubic yard cars, two 20-ton electric locomotives and 1½ mile of flume. A permanent washing station will be built on the hogback near the canon, giving 160 feet of a dump, and the dump is at a point where the creek has a 12 per cent. grade. Ten cars will be dumped at one time, and all boulders will be hydrauliced on the grizzly under 150-foot head. There is a 120-foot dump for the grizzly. The system is gravity throughout. Owing to the heavy grade on this creek, the haul will be less than one-half mile on a down grade of one foot per 1,000 feet. The physical conditions are very favorable to economic working. A small sawmill will be taken in this winter on the ice, and the lumber sawed on the ground.

"The Guggenheims have made a success of their steam shovel on Tar Flats this summer, and I understand have bonded one-third of the district, so that I expect next year will see a great deal of development work, and the installation of new plants will greatly add to Atlin's output, and make it one of the heaviest gold-producing sections of the North."

WINDY ARM AND WHITE HORSE.

In both these districts extensive work has been going on all last season. A large number of properties are being opened up in and around Conrad City and Wynton, a town on the British Columbia side of the boundary line, built at the foot of Windy Arm.

Near Tutshi Lake some rich strikes have been made, copper, gold and silver values being very high in many of the ores found.

In all probability a smelter will be built at White Horse this summer.

The ores there are rich in copper, some shipments having realized 30 per cent. net at Tacoma, Wash., U.S.A., smelter. This long haul militates against the successful development of the camp and it is reported on excellent authority that Capt. John Irving of Victoria, B.C., the pioneer in copper mining, has succeeded in raising the necessary capital for the erection and working of a smelter in the White Horse district.

It is also reported that a large concentrating works will be erected at Conrad City to reduce the ores of the Windy Arm camp.

COAST DISTRICT.

The writer has just returned from an extended trip up the British Columbia coast and found throughout the entire coast line the signs of the most encouraging activity. The weather at present and for some time past has been too severe to permit of much work being done, but just as soon as the spring opens there will be one of the most startling mining booms that the coast has ever seen. During the trip I interviewed several miners returning from Portland Canal and the interior and all had the same story to tell of splendid mineral found and lots of it. Coast mining will be the subject of a future article and anticipating that I will briefly review the actual mining done on Portland Canal, Texada and Vancouver Islands.

Portland Canal. — The progress of this camp during the past season has justified all expectations. The many properties on which development work has been done has proved the fact that the ore bodies are of great extent and permanency.

Several new strikes were made, and of the many prospectors who visited the district, and prospected for the season, not one failed to locate property of value. Many of these also took up pre-emptions and purchased lots in the townsite, and erected houses on their holdings.

A considerable number of mining claims changed hands, and many more deals would have been made, but the prospectors for the most part refused to consider any proposition other than a part cash payment down, which in most cases led to the deal falling through. This policy is bad for the camp and and also for the prospector.

The delay in commencing the construction of the bridge across the Bear River, which is confidently expected will be built this fall, retarded progress greatly; the heavy snowfall of last winter caused an unprecedented high water in June and July, which rendered the cable by which the river is at present crossed unavailable for days at a time. In attempting to ford the swollen stream a party of prospectors were swept off their feet and only succeeded in reaching the shore by a miracle.

On Glacier Creek the greatest activity was manifested. McGrath and Griffin have exposed their lead on the Little Joe and Lucky Seven for the entire distance of the two claims, and have crosscut it in several places, exposing ore in every cut. They have also run 30 feet on the vein, and will continue work all winter. The Stewart Trading Company have an option on this property, which is one of the best located in the district, being only five miles from tide water and at an elevation of 2,000 feet. The average width of the vein is six feet, which is galena and iron pyrites with considerable lead carbonates, and the values run from $30 to $400 per ton in silver, lead and some gold. The vein lies in the contact between slate and porphyry, and the strike is N.W. and S.E., being the same as practically all the ledges in this district.

Adjoining McGrath and Griffin's property the Portland Development Company have a force of men at work sinking a shaft on their main lead, the ore of which is similar to other veins in the vicinity, the iron pyrites carrying gold to the amount of $60 per ton.

On the Olga, purchased a year ago, for a few hundred dollars, D'Arcy McDonald has a good showing, an average assay of the dump giving $51 in silver and lead.

A half interest in the Jumbo group was sold to S. Silverman, of Seattle. S. Gourley, who still retains the other half, has refused many offers for his interest. No work was done on this property other than the usual assessment work, which was also the case on the adjoining claims, the Halla and June. An offer to bond these claims for $30,000 was refused a year ago, but a deal is now pending at an increased figure.

Some new locations were made adjoining these claims by J. Welch, P. Boyle, Hucker and Strickland, of Ketchikan. This ore is arsenical iron pyrites, and carries values gold, $37; silver, 6 oz.; copper, 2 per cent. A group of claims was also located by J. Perault, for Ketchikan people on similar ore, three miles further south, the average from which was $10 in gold.

Rush and Bagg have been working on their lead all summer, and have proved the property to their satisfaction. Some of the ore from this claim runs 2,000 ozs. in silver.

On claims owned by M. K. Rogers the usual assessment work was done. The Copper King was bonded by G. M. Brown, of Seattle, the first payment has been made, and Mr. Brown, who is now in Seattle, is expected back shortly, with material to work the property all winter. This ledge is 39 feet in width, and carries values from 8 to 12 pert cent. copper with a little gold.

McKay and Bibeau will ship some ore this fall from their claim, which is proving, on development, to be one of the best in the district.

Bert Ranche will make a ten-ton trial shipment from his claim, the Main Reef, as soon as the Stewart Land Company have finished their floating wharf. The ore averages $90 in silver and lead, and the property is favorably situated, being only six miles from tide water.

On the Sunbeam the ledge has been traced throughout the entire claim, and open cuts run, showing up a large body of ore, with a well defined pay streak.

Several new locations were made on Bitter Creek, of which the Copper Canyon group seems the most promising. The main ledge on this property is three feet in width, lying in slate and porphyry, and contains values of $41 in copper and gold.

On the Roosevelt, a copper-gold property on which development work has been carried on for some years, a four-foot vein of galena was located, which promises to rival the original location both in extent and value.

While doing assessment work on the Rainier, Fred Rainey discovered a three-foot vein of galena and quartz with about eight inches of lead carbonates, an assay from which gave $174 in silver and 60 per cent. lead.

Among new locations made was the Greenhorn group, a three-foot ledge of quartz carrying copper 12 to 20 per cent., silver 6 oz. Also a group of claims 22 miles from Stewart on an iron cropping carrying values in gold and copper.

On American Creek, the American Girl group maintains its pre-eminence. Only assessment work was done on the claims this season by the owners, who, owing to the San Francisco disaster, were involved in a delay in regard to the taking over of the property. A new lead was discovered on the ground carrying high values in silver.

On the May Bee and Louise a tunnel was run on the ledge which is 17 feet in width; the pay streak is 2½ feet, and averages $35 in silver. This ledge is crosscut by a canyon, and a vertical depth of over 100 feet of the vein is exposed.

Assessment work was also done on the Rangoon and Bandolier, and some good ore discovered, assays giving silver, $341; copper, 27½ per cent.

Work was carried on all winter on the Kansas group, and 70 feet of tunnel run. Some new locations have also been made on this creek which promise well. The season is now practically over, and many of the prospectors are leaving. Many have gone to Maple Bay Mines, where 150 men are now at work. It is expected that about 50 men will winter here, and should the erection of the bridge be commenced immediately probably many more will remain.

Texada Island.—On Texada the Marble Bay Mine has been steadily shipping high grade bornite ore all the year at the rate of 1,000 tons per month, netting the operating company about $25,000. This mine is perhaps the most profitable in British Columbia and has the best showing of copper ore in the province. The ore at present being mined is obtained at the 800-feet level which is 950 feet below sea level. The writer visited the mine last April and thanks to the courtesy of the manager, Mr. Alexander Grant, had the privilege of examining the mine in company with Mr. Charles Sangster, the coast representative of the Rand Drill Company, and several well-known mining men from Vancouver, including Mr. W. Thos. Newman, M.C., M.I., and the foregoing facts were ascertained then and have since been corroborated by many.

Further north, on Texada Island, the Loyal group owned and operated by Mr. Jacobs, of Seattle, is showing up well as are also the Copper Queen and the Cornell adjoining the Marble Bay. The two are operated by Seattle capital and are both paying good dividends.

Half way across the Island and five miles from the Marble Bay, W. Thos. Newman is opening up the Commodore Mine with considerable success. The showings on this property are remarkable and the geological conditions offered a field for the most thoughtful consideration and were most carefully investigated before any work was undertaken.

The work on the Commodore is now in an advanced stage and Mr Newman reports that next summer will see the Commodore a big producer.

Vancouver Island.—The Tye Mine, on Mount Sicke, has continued to ship ore all year and, in addition, has been steadily sinking, prospecting for the ore body at depth. In this mine the main ore body extends through Mount Sicke in the form of a huge shoot at about the 300-feet level. This shoot is about exhausted but the management has succeeded in locating similar ore but of much lower grade at the 1,000-feet level, and is now cross-cutting this body at the 1,250-feet level. Whether this cross-cut has cut pay ore or not is not yet known. The Tyee Company, however, is in splendid shape, and after paying dividends for years, building a smelter and operating the mine, has the original capital intact in the books in London, Eng., and can by securing new ground still continue business. Mr. Clermont Livingstone, the resident managing director, reports that work on an adjoining property, the X. L., is showing up some good ground.

Adjoining the Tyee is the Richard III, in which, recently, an important strike of high-grade copper ore was made. This property will be one of the

Canadian Government Mineral Exhibit, Christchurch, New Zealand.

most important shippers in Vancouver Island this coming year.

On the west coast of Vancouver Island, there is every prospect of renewed life in a mining sense this year. Very little work of any description was done last year.

THE INTERIOR.

While on the coast there has been, and is, a very healthy movement in mining, the interior mines have been the mainstay of the industry during the past year. The great bulk of the tonnage has, as can be seen from the table of shipments given at the beginning of this article, come from the Boundary country, assisted materially by Rossland and Slocan-Kootenay.

The greatest producer has been, and is, the Granby Company, operating at Phoenix. Out of a total ore tonnage from the Boundary country of 1,155,138 tons, this company shipped to their smelter at Grand Forks, 804,598 tons or 69 per cent. The Dominion Copper Company ranks next with 216,788 tons and the British Columbia Copper Company third, with 121,241 tons.

The output of the latter company was curtailed very considerably owing to the fact that the plant at Greenwood was closed down for several months while the smelter capacity was being doubled. The smelting capacity of this plant is now 1,500 tons per day and a very large increase may be looked for from the British Columbia Copper Company's mines this year.

According to Mr. W. B. Wilcox, the editor of the Phoenix Pioneer, to whose excellent special number, just published, I am indebted for the information on the Boundary, in six years and a half the mines of the Boundary have sent out to the district smelters approximately 4,644,000 tons of ore. This is from 1900, in the midle of which year ore shipments were commenced, to the end of 1906. It will thus be noted that the progress has been little short of marvellous. In 1900 but 97,000 tons were shipped, while in 1906 a total of about 1,191,000 tons of Boundary ore were dug out of our mines and sent down the hills in different directions to the three district reduction works—eleven times as much in 1906 as in the year 1900. To show the yearly progress and increase of output the following table is given:—

1900	97,000 tons.
1901	390,000 "
1902	509,000 "
1903	690,000 "
1904	830,000 "
1905	953,000 "
1906 (Dec. estimated)	1,191,000 "
Grand total	4,660,000 "

Not only has the British Columbia Copper Company increased the capacity of their smelting plant but the Granby Company has also considerably enlarged some of their furnaces, and at present the Dominion Company are spreading out and are at least doubtling their smelter capacity at Boundary Falls.

The recovery of copper per ton from the ore of the mines of the Boundary is known to be low, comparatively speaking, and an average rate of 25 to 30 pounds per ton is considered conservative. On this basis, the copper fine production of the Boundary mines for the first year of ore shipping, 1900, was but 3,000,000 pounds. On the same basis, the recovery for 1906 will amount to about 35,000,000 lbs.—an amount sufficient to make it worth while in the world's grand total. Altogether the mines of the Boundary in these seven short years, have contributed approximately 140,000,000 pounds of copper. In addition to this there are the gold and silver values to be considered. The values of the ores thus treated would amount to more than $25,000,000, not taking into consideration the high prices prevailing for the brown metal for the last year or more.

The Granby Company is spending about $100,000 at present on the Victoria property shaft and headworks. This shaft, when completed, will be the permanent working outlet for the whole of the company's mines in Phoenix. They are now down 400 feet, the shaft has been timbered and will be ready for use in the early spring. The hoisting engine will be driven by electricity and is 250 h.p. There are at present two crushers of 150 tons per hour, minimum, capacity and another is being installed at the headworks of a like size, giving the company the necessary machinery to crush 450 tons per hour, minimum.

Ore bins are being erected at the shaft and both the Canadian Pacific and the Great Northern Railway companies are making arangements for connections.

Development work has been steadily pushed and is now years ahead of needs. More properties have been secured. The Gold Drop group has been extensively exploited and has proved the property has immense tonnage. On the Curlew a large tonnage has also been opened up. This claim being below the Gold Drop may eventually be used to tap the ore reserves of the latter by means of tunnelling.

On the Dominion Copper Company's property new machinery is being installed with a view to increasing the shipments to meet the requirements of the new enlarged smelter.

The B.C. Copper Company has been working towards a much larger output from their Mother Lode mine. The output from this mine will be trebled and will, it is confidently expected, ship 1,500 tons per day this year. The Emma, in Summit Camp, on the C. P. R. branch, from Eholt to Phoenix, has also been extensively developed. The company, last year, purchased outright the Oro Denoro, adjoining the Emma of the B.C. mine in the same camp. The B.C. mine, in the past, has shipped 100,000 tons of ore while the Oro Denoro is known to have large reserves of ore which can be cheaply mined, and being situated right on the railway very cheaply shipped.

A most important feature in connection with the huge operations in the Boundary country, is the fact that the Granby Company has paid dividends during the past year at the rate of 12 per cent. on a capitalization of $15,000,000 on 1.1 per cent. copper ore. Considering that the original price of the stock was 25 cents on the dollar this means that original holders received, last year, about half their original investment back in the shape of dividends and hold their stock now at 33 per cent. above par.

One important feature of the year's development in the mines of the Boundary was the advent of the Consolidated Mining & Smelting Company of Cananda to Phoenix, when that company took a lease on the well known Snowshoe mine here. That this company, which is operating so successfully at Rossland, should reach out into the Boundary and take up one of the large properties, is another evidence that the Boundary is attracting the attention of more and more mining men of note. The Snowshoe is now shipping ore daily.

While Boundary's copper mines have been shattering all previous records for output, etc., the high grade silver and gold mines of this section have not been forgotten. Chief among these is the Providence, near Greenwood, which is to-day a better mine than ever before. A dividend of some $16,000 was paid in September, and development with some 35 men has been steady all this year. The company will doubtless make an even better record during the year to come.

The Skylark is another silver mine that has done well, having paid for development and the bond also from the proceeds of the ore shipments in the last two years. Its Phoenix owners should begin to receive some profits this coming year.

Among the large number of mines in the high-grade belt that are looking well and doing satisfactorily may be mentioned the Elkhorn, Prince Henry, Strathmore, Bay, Mavis, Crescent, Don Pedro, E. P. U., Helen, Tip Top, Greyhound, Moreen and a dozen others.

(To be continued.)

THE CANADIAN ROCKIES.*

By Reginald A. Daly.

(Continued.)

It is well known that one of the first designations of the entire mountain group lying between the Pacific and the Great Plains was due to Humboldt. His " Cordilleras of the Andes " extended from Cape Horn to the mouth of the Mackenzie river. Humboldt occasionally used the singular form " Cordillera of the Andes " for the same concept. In view of the general restriction of the term " Andes " to the mountains of South America, Whitney, in 1868, proposed that the name " Cordilleras," with variants, " Cordilleran System " and " Cordilleran Region," be retained to designate the North American equivalent of the Andes. This name was adopted in the United States census reports for 1870 and 1880, and by a great number of expert geologists and geographers since 1868. In process of time, however, the singular form, " Cordillera " and variants, became used in the same sense. In one of these forms the Humboldt root word with Whitney's definition has entered many atlases. It appears on numberless pages of high-class Government reports, geographical, geological, and natural history memoirs, and of such works as Baedeker's "Guide-book to the United States," Stanford's " Compendium of Geography," etc.

The time-honored, erroneous, similarly inclusive name " Rocky Mountains," with variants, " Rocky Mountain System," " Rocky Mountain Belt," etc., has, however, held the dominant place in the popular usage. Its inappropriateness for the heavily wooded Canadian mountains is abundantly evident. For the United States, Clarence King wrote a generation ago—

" The greatest looseness prevails in regard to the nomenclature of all the general divisions of the western mountains. For the very system itself there is as yet only a partial acceptance of that general name Cordilleras, which Humboldt applied to the whole series of chains that border the Pacific front of the two Americas. In current literature, geology being no exception, there is an unfortunate tendency to apply the name Rocky mountains to the system at large. So loose and meaningless a name is bad enough when restricted to its legitimate region, the eastern bordering chain of the system, but when spread westward over the Great Basin and the Sierra Nevada, it is simply abominable."†

The following table summarizes the above-mentioned variants along with others more recently introduced, and still other general names now only of historical interest. The names of prominent authorities and the leading dates when they have published the respective titles are also entered in the table. The authority for some of the older names is Whitney's work on the United States, published in Boston, 1889.

Mountains of the Bright Stones—
  General use, end of eighteenth century.
Shining Mountains—
  Morse, " Universal Geography," 1802.
Stoney or Stony Mountains—
  Arrowsmith, 1795; President Jefferson.
Columbians (*sic*) Mountains—
  Tardieu, 1820.
Chippewayan Mountains—
  Hinton, 1834.
The Cordilleras of the Andes (in part)—
  Humboldt, 1808, etc.
The Cordillera of the Andes (in part)—
  Humboldt, 1808, etc.
The Cordilleras—
  Whitney, 1868; many authors since.
The Cordillera—
  G. M. Dawson, 1884, etc.; Gannett, 1898; Rand-McNally, 1905.
The Western Cordillera of North America—
  J. D. Dana, 1874, 1880.
The Cordilleras of North America—
  Hayden, 1883; Leconte, 1892, etc.
The Cordilleran Region—
  Whitney, 1868, etc.; Hayden, 1883; Shaler, 1891.
The Cordilleran System—
  Whitney, 1868, etc.; King, 1878; Baedeker, 1893.
The Cordilleran System—
  Hayden, 1883.
The Cordillera Belt—
  G. M. Dawson, 1879; etc.; Rand-McNally, 1902.
The Pacific Cordillera—
  Russell, 1899, 1904.
The Cordilleran Plateau—
  Hayden, 1883.
The Cordillera of the Rocky Mountains—
  J. D. Dana, 1895.
The Rocky Mountain System—
  Leconte, 1892, etc.; Heilprin, 1899; many others.
The Rocky Mountain Region—
  Powell, 1875, etc.; G. M. Dawson, 1890; Gannett, 1899.
The Rocky Mountain Belt—
  Rand-McNally, 1902.
The Rocky Mountains—
  Lewis and Clarke; popular.
The Pacific Mountains—
  Russell, 1899, 1904; Powell, 1899.
The Western Highland.
  Baedeker, 1893; Keith Johnston Atlas, 1896; Davis, 1899.
The Rocky Mountain Highland—
  Frye, 1895, 1904.
The Western Plateau—
  English Imperial Atlas, 1892.

(To be continued.)

* Published by permission of the Canadian Commissioner, International Boundary Surveys.

† " U. S. Geological Exploration, 40th Parallel, Systematic Geology, 1878," p. 5.

THE TREATMENT OF ARSENICAL ORES.

By Chester F. Lee, Mining Engineer.

The Cascade range is noted for the arsenical character of many of its ores. At Monte Cristo, Goat Lake, Silverton, Silver Creek, Elba and many other places a considerable arsenic content is a characteristic. Not all the ores of this range are arsenical by any means, but those in which this constituent is prominent are so widely spread and so considerable in amount that the handling of them and the getting of some return for the arsenic contained is a vital matter. The only plant in the state that can make marketable arsenic (the white arsenic of commerce, As 2 O3) is at Everett, and indeed, until 1904, when the Anaconda works in Montana were supplied with a plant for extracting arsenic from flue dust, this was the only place in the United States where it was made.

At the present time, what ores of this class are treated at all are shipped to smelters and treated as gold or silver ores pure and simple, and a penalty of about 50c is exacted for each per cent. of arsenic over a certain amount and the smelters refuse to take on any terms ores high in this metal; as they claim that the volitilization of arsenic in the roasting furnaces and the smelter stacks causes undue losses of the precious metal. Producers of ore have long contended that not only should they not be penalized for their arsenic, but they should be paid for it. They point out that the Anaconda works has produced, in the three years ending July 1st, 1906, 1,107,176 pounds of white arsenic, all of which was sold at a good price and all of which came from a by-product, flue dust.

If this is the case, how much more ought their ores, rich in arsenic and of fair gold and silver values, to have the treatment suited to them the pecuniary benefit of which would be felt in every mining district of the state.

The quantity of these ores and the development work done on the properties that can produce them is sufficient to warrant a constant and increasing supply; why, then, cannot this metal receive the same sort of attention accorded to copper, lead, zinc, etc.? The reason probably is that the metallurgy of arsenic has had no attention in this country, as heretofore there has been no visible supply of the raw material. The beginning of better things seems to be now at hand, and the American Smelting & Refining Co., to whose tender merices we seem to be irrevocably committed as far as reduction works are concerned, are said to have promised some return for arsenic in a certain district, provided a sufficient tonnage to be regularly shipped was guaranteed them.

White arsenic is worth on the average from 3 to 3½ cents per pound. This is the grade known as "commercial."

You will see quoted in the lists of chemicals "refined" and "C.P." (chemically pure) at rates several times this and at the present time, in sympathy with other metals, the price is considerably above this, but an average of 3½ is all that it is safe to count on year in and year out, for the unrefined product.

The general run of the Cascade ores of this class contain from 3 to 10 per cent. of metallic arsenic (As.). About 6 per cent. may be taken as a fair average, as that is what a careful sampling of two of the best known mines gives. Six per cent. metallic arsenic will produce 160 pounds of commercial white arsenic theoretically (6 per cent. is 120 pounds per ton; allow one-third more for the oxygen absorbed from the air, as the atomic weight of As2 is 150, and of O3 is 48.), and we have 160 pounds white arsenic, allow 5 per cent. loss on this in the process of obtaining it, and we have 150 pounds net; now deduct for the cost of reduction, packing in barrels, freight, etc., 1½c per lb., and we have 150 pounds at 2c., or $3.04 as a fair return on a 6 per cent. ore. Many of our Cascade ores carry from $6 to $10 in gold and silver, and this extra $3 would make all the difference with them between success and failure, between profit and loss in the mining operations. It costs not a cent more to get this ore out than formerly, and if $3.00 even can be added to the returns, it is an addition to the net.

Aside from the possibilities of shipping and smelting the ore raw there are at least three other courses open: 1. Water concentration with subsequent smelting of concentrates. 2. Cyanidation of the raw ore for gold and silver, and subsequent roasting for arsenic. 3. Roasting for arsenic with subsequent smelting of the roasted residue.

To take them up in order: Water concentration has been tried at Monte Cristo with only partial success. The sulphides and arsenides which carry the values are softer and more brittle than the quartz in which they occur and excessive fines and slimes result from grinding, the losses in this particular case are said to have run from 30 to 40 per cent. This mill has been lately repaired and will begin a new campaign in the spring under new management and the results will be looked for with interest. There are arsenical ores in other places in the Cascades better adapted to concentration than those of Monte Cristo, ores that are less massive and more granular as to the sulphides and in which the quartz and other gangue matter is not so tough and hard.

Raw cyaniding of sulphide ores has made a good deal of progress in the last few years and has been very successful in a number of cases. Cascade arsenical ores have been the subject of experiment here in Seattle in the laboratory and on a small practical scale and enough has been done to show that the thing is feasible in this case. An extraction of gold of 80 to 90 per cent. has been obtained and the estimated cost in a 100-ton plant is $1.50 a ton for operation. After cyaniding and washing the ores can be roasted for arsenic. This roasting should not cost more than 50 cents per ton.

The third possibility is to roast the ore first for arsenic in a comparatively inexpensive plant at the mine and ship the roasted ores to the smelters for the extraction of the precious metals. This would obviate many difficulties at present encountered. The ore would be freed from nearly all the sulphur as well as their arsenic, which would result in a slight enrichment of the product, the arsenic could be marketed by the producer and the smelters would be eager to get the desulphurized and dearsenuretted product and would be willing to pay good rates for it.

Good returns await the company that has ore reserves large enough and the courage great enough to be the pioneer along these lines. Either of the two latter methods should be the subject of careful experiment on a small working scale before works of any size are built. Under competent direction tests can be made at a reasonable cost with results that will be reliable and of great benefit to the mine owner and the mining industry of this section.

CORRESPONDENCE.

FROM THE ANTIPODES.

Dear Sir,—

I have sent you, under separate cover, photos of the mineral section of the Canadian Exhibit. It is by far the largest and most complete collection of economic minerals here, and our installation is quite different from any of the other exhibits.

The exhibition was opened on the 1st of November by the Premier, Sir Joseph Ward, and his first official visit was to the Canadian Court. He was very much impressed with the extent of our mineral resources.

The general public are more interested in our exhibit of asbestos, mica, nickel and cobalt, these minerals being new to New Zealand.

I have not had time to visit the mining districts, but will do so later on, the Minister of Railways having given me every facility for doing so.

The attendance, so far, has been very good and there is every prospect of the exhibition being a great success. Up to date the number of admissions is over 517,000.

New Zealand is a delightful country and the people the most hospitable I have ever met. There is no doubt whatever but that the trade relations between Canada and New Zealand will be materially increased as a result of the exhibition.

I shall be pleased to send you my impressions of the different mineral exhibits here, also anything I may come across during my trip through the colony.

With best wishes for the New Year.

Yours very sincerely,

R. L. BROADBENT,

The Editor, Canadian Mining Review,
Montreal.

[We reproduce in this issue two interesting photographs that accompanied Mr. Broadbent's letter.—Editor.]

We are requested to state that all communications, mail and express matter to the American Institute of Mining Engineers, or the United Engineering Society Building, should be addressed to 29, West 39th Street, New York City.

EXPERIMENTS WITH COBALT ORES.*

By Henry M. Howe, LL.D., William Campbell, Ph.D., and Cyril W. Knight, B.Sc.†

(New York Meeting, April, 1907.)

This paper gives the results of an investigation of the behavior of the argentiferous cobalt-nickel arsenides of Temiskaming, Ontario, in roasting, made in the metallurgical laboratories of the School of Mines of Columbia University in the City of New York. The ore was kindly given by the owners of the La Rose and Trethewey properties at Cobalt, Ontario, and Mr. E. J. Hall, Tutor in Assaying in Columbia University, has helped us much.

I. Object of the Investigation.

The object of the investigation was to learn:—

1. The temperature at which the arsenic is most rapidly expelled;
2. The thoroughness with which it is expelled by prolonged roasting at this temperature;
3. The effect of adding charcoal (a) near the end of the roast and (b) at the beginning of the roast.

II. Nature of the Ore.

The important ores mined in the Temiskaming deposits are: native silver—with small amounts of dyscrasite (Ag_6Sb), argentite (Ag_2S), pyrargyrite (Ag_3SbS_3)—smaltite ($CoAs_2$), chloanthite ($NiAs_2$) and niccolite ($NiAs$). Mispickel ($FeAsS$) and cobaltite ($CoAsS$) also occur in smaller quantities. The average composition of the ore shipped from this district for the first six months of 1905 was: silver, from 4.1 to 4.8 per cent.; cobalt, from 6.9 to 8.2 per cent.; nickel, from 3 to 4.7 per cent.; and arsenic, from 30.9 to 34.6 per cent. The ore which we treated consists chiefly of smaltite. In our laboratory-work the temperature was kept below the melting-point of silver (960° C.) in order to prevent loss of that metal, though our preliminary experiments showed that these ores do not frit or clog at this or even at a somewhat higher temperature.

The Temiskaming ores contain little gold, only $0.40 per ton in case of the ores which we treated.

III. Sampling and Assaying.

About 43 lb. of the ore, in lumps about 3-in. cubes, were crushed so as to pass through a sieve of 20 meshes to the linear inch. In this crushing we caught and separated particles of metallic silver which represented about 75 oz. of silver to the ton of ore, or about 11 per cent. of its total value. Some of these particles were about 0.25 in. in diameter.

For assaying, a lot of 37 assay-tons was next separated from this crushed product by means of a "split" sampler, and then ground so as to pass a sieve of 100 meshes to the linear inch. In doing this a second lot of metallic silver particles, representing 117 oz. per ton of ore, was separated.

The results of 12 crucible-assays and 9 scorification assays were:—

	oz. per ton of ore
Metallic silver by the crucible process.......	477
Metallic silver by the scorification process. ..	497
Add metallic silver separated in crushing.. ..	75
Add metallic silver separated in grinding. ...	117
Total silver-content	689

The ore contains 56 per cent. of arsenic.

For the silver-assay the following quantities were used: For scorification, 0.2 A.T. of ore was roughly divided into halves, each of which was scorified with 60 g. of lead and 1 g. of borax-glass. The resulting two beads were weighed together. For the crucible process, 0.5 A.T. of ore, 2.5

* A paper to be read before the American Institute of Mining Engineers, April meeting.

† Respectively Professor, Instructor and Student of Metallurgy in the School of Mines of Columbia University in the City of New York.

A.T. of lead oxide, 2-3 A.T. of soda, 1-3 A.T. of borax-glass, and 4.5 g. of argol were used.

IV. The Roasting.

The roasting was done in an American Gas Furnace Company's oven, 27 in. long and 20 in. wide inside.

The ore was held in shallow iron pans resting on the hearth of this furnace, and lined with 0.5 in. of fire-brick.

The temperature was measured by means of a Le Chatelier pyrometer. The thermo-couple was protected from arsenic and other fumes by a porcelain tube, and was placed immediately above the ore. It entered through a circular hole in the back of the furnace and was connected with a Keiser and Schmidt galvanometer, standardized by means of the melting-points of zinc, aluminum and copper. The temperature was recorded and the ore rabbled every 10 min. In none of the roasts was any fritting or clogging of the ore noticed.

V. At What Temperature is the Arsenic Expelled Most Rapidly?

Roast No. 1.—In this test, 3.5 lb. of the ore, crushed to pass a 20-mesh sieve, were placed in the furnace, the temperature of which had previously been raised to 490° C. The temperature was then gradually raised at the rate of about 120° C. per hour, until it finally reached its highest point, 870°C. Samples were taken with the usual precautions, and their arsenic was determined by fusion with sodium peroxide, neutralizing with acetic and sodium hydroxide (using phenolphthalin as an indicator), precipitation as silver arsenate with silver nitrate, and titrating with ammonium thiocyanate.*

The results of the roast are given in Table I.

Though the arsenic escaped pretty rapidly at first, yet towards the end of the second hour its escape was almost completely arrested, in spite of the continued regular rise in temperature. But when the temperature reached 840°, the expulsion of arsenic again became rapid. These results tend to prove that the behavior of smaltite resembles that of pyrite, of which the first atom of sulphur is removed at a much lower temperature than the second.

Table I.—Record of Roast No. 1. Gradually Rising Temperature.

Temperature of Roast. Deg. Centigrade.	Time from the Beginning. Hr. Min.	Quantity of Arsenic in Ore at Different Stages of the Roast Per Cent.
490	0 : 00	55.9
559	0 : 25	
547	0 : 35	
577	0 : 45	
591	0 : 55	
596	1 : 00	46.6
601	1 : 05	
611	1 : 15	
624	1 : 25	
641	1 : 35	
666	1 : 45	
691	1 : 55	
706	2 : 00	40.7
721	2 : 05	
735	2 : 15	
763	2 : 25	
788	2 : 35	
814	2 : 45	
828	2 : 55	
838	3 : 00	40.3
848	3 : 05	
844	3 : 15	
864	3 : 25	
858	3 : 30	35.4
872	3 : 35	
863	3 : 45	31.0

*Miller's Quantitative Analysis for Mining Engineers, p. 114.

Conclusions.—1. That 15 per cent. of arsenic (per 100 of ore), i.e. 27 per cent. of the total arsenic, is expelled below 700° C.

2. That the rest of the arsenic is not expelled until the temperature reaches about 840°, when rapid expulsion again sets in.

VI. How Thoroughly Can Arsenic be Expelled at 890° C ?

Roast No. 2.—In this roast about 3 lb. of ore, ground to pass a sieve of 20 meshes to the linear inch, were raised quickly to about 890° C. (a temperature a little above that which Roast No. 1 had shown that arsenic is rapidly expelled), and held near that temperature for about four hours, with frequent rabbling.

As shown in Table II, the arsenic was expelled fairly rapidly until it had fallen to about 20 per cent., but thereafter very slowly.

Table II.—Record of Roast No. 2. Temperature Held Near 890° C.

Temperature of Roast. Room Temperature. Deg. Centigrade.	Time. Hr. Min.	Quantity of Arsenic in Ore at Different Stages of the Roast. Per Cent.
463	0 : 35	55.9
533	0 : 45	
622	0 : 55	
693	1 : 05	
738	1 : 15	
795	1 : 25	
846	1 : 35	44.6
895	1 : 45	
895	1 : 55	38.0
909	2 : 05	
897	2 : 15	26.3
901	2 : 25	
886	2 : 35	21.7
883	2 : 45	
883	2 : 55	19.3
883	3 : 05	
885	3 : 15	
889	3 : 25	
883	3 : 35	18.3
891	3 : 45	
894	3 : 55	
899	4 : 05	
897	4 : 15	
902	4 : 25	
900	4 : 35	17.5
900	4 : 45	
898	4 : 55	
887	5 : 05	
883	5 : 15	
878	5 : 35	17.3

VII.—Does Charcoal Added after Roasting at 890° Cause Further Expulsion of Arsenic?

Table III.—Record of Roast No. 3. Charcoal Added After Roasting Near 890° C.

Temp. of Roast. Room Temp'ture. Degrees Centigrade.	Time from the Beginning. Hr. Min.	Quantity of Arsenic in Ore at Different Stages of the Roast Per Cent.
470	0 : 35	55.9
606	0 : 45	
660	0 : 55	
723	1 : 05	
815	1 : 15	
856	1 : 25	
873	1 : 35	
886	1 : 45	
872	1 : 55	
864	2 : 05	
870	2 : 15	
874	2 : 25	
888	2 : 35	
875	2 : 45	
897	2 : 55	
890	3 : 05	15.8

Canadian Government Mineral Exhibit, Christchurch, New Zealand.

Charcoal added here.		
882	3 : 20	
882	3 : 35	
894	3 : 50	
884	4 : 05	15.0

Roast No. 3.—In order to learn whether an addition of charcoal after long roasting between 840° and 890° C. (temperatures between which we had found that arsenic is expelled rapidly) causes further expulsion of arsenic by reducing the fixed arsenates to the volatile forms of arsenious acid and metallic arsenic, one of us roasted a third lot of ore at temperatures between 870° and 890° for 1.5 hr., and, without removing it from the furnace, he then stirred in 10 per cent. by weight of charcoal, ground so as to pass a sieve of 10 meshes to the linear inch, but not one of 20 meshes. The results are shown in Table III. If too coarse, charcoal disintegrates and scatters the ore, and if too fine it burns away too fast.

At the time of adding the charcoal, fumes of arsenic had ceased to be visible, but this addition caused a sudden evolution of dense fumes, which lasted for only a few minutes.

The charcoal had little effect on the arsenic. Before its addition the ore contained 15.8 per cent. of arsenic, and 1 hr. later this had fallen only to 15 per cent.

In this roast, after the ore had been exposed to a temperature above 856° for 1 hr. 40 min., its arsenic-content had fallen to 15.8 per cent., whereas in Roast No. 2, after it had been exposed 2 hr. to temperatures above 846°, it still contained 18.3 per cent. of arsenic. This difference tends to show that unnoticed variations in conditions may materially influence the rate of expulsion, as is the case in many roasting-operations.

The fact that the arsenic was expelled in this roast, before the addition of the charcoal, more thoroughly than in any of the others, in spite of the very rapid raising of the temperature at the beginning, goes to show that the behavior of smaltite differs in an important way from that of pyrite, the temperature of which must be raised very carefully and slowly, lest the fritting or enamelling of the outer surface of the individual particles prevent the free access of the air to their interior, and thus arrest the roast.

VIII.—Does Charcoal Added at the Beginning of the Roast Increase the Expulsion of Arsenic?

Roast No. 4.—About 2 lb. of ore were mixed with 10 per cent. by weight of charcoal, raised to 880° in 2 hr., and held near that temperature for 1.75 hr. more, or a total of 3 hr. 45 min. The charcoal seems to have had little effect, because at the end of this time the ore still contained 17.5 per cent. of arsenic, or more than in Roast No. 3 after it had been above 856° for 1 hr. 40 min., and but little less than in Roast No. 2 after it had been above 795° for 2 hr. 10 min.; and in each of these latter cases the expulsion of arsenic was brought about without the use of charcoal.

These cases are here recapitulated:—

Roast.	After Remaining Above	For	The Ore Still Contained
No 2	846° without charcoal.	2 hr.	18.3 per cent. of arsenic
No. 3	856° without charcoal.	1 hr. 40 min.	15.8 per cent. of arsenic
No 4	880° with charcoal.	1 hr. 45 min.	17.5 per cent of arsenic

IX.—Does Finer Grinding Increase the Expulsion of Arsenic?

Roast No. 5.—In order to learn whether finer grinding would lead to further expulsion of arsenic by exposing the ore more fully to the air, the ore which had already undergone Roast No. 3 was re-ground so as to pass a sieve of 100 meshes to the linear inch, and re-roasted for 2 hr. 30 min. at about 880° C.; but this re-roasting caused no farther expulsion of arsenic.

X.—Summary of Results.

The following conclusions apply only to the particular ore here treated:—

1. The percentage of silver as determined by the scorification-method is about 4 per cent. higher than as determined by the crucible-method.

2. The ore neither clogs nor frits at or even somewhat above 960°, the melting-point of silver.

3. The arsenic can be reduced from about 56 to 41 per cent., or by 15 per cent., by roasting below 700° C. (Roast No. 1, Table I.).

4. It can be further reduced by about 24 per cent., viz.: —to 17 per cent., by roasting at temperatures above 840°, and in this higher range the arsenic is removed much faster than at lower temperatures. (Roast No. 2, Table II.).

5. Hence our inference that the behavior of smaltite in roasting is probably analogous to that of pyrite, which loses its first atom of sulphur much more readily than its second; yet, unlike pyrite, this ore may be raised suddenly to 800° without harm, because, unlike pyrite, it does not frit or enamel when thus suddenly heated, but remains open and porous, so that the air may penetrate it. (Roast No. 3.)

6. Charcoal, whether added at the beginning or towards the end of the roast, fails to increase the expulsion of arsenic. (Roasts 3 and 4.)

7. We doubt whether it will pay to reduce the arsenic-content below 20 per cent.; even by roasting at temperatures above 890° C., because its further reduction is very slow.

A NEW MINING ASSOCIATION.

The Hastings (Ont.) Mining Association has been incorporated with the following members:

Mr. W. A. Hungerford, Vice-President of the Atlas Arsenic Co., was unanimously elected President.

Mr. Arthur Coe—1st Vice-President.

Mr. E. B. Davies—2nd Vice-President.

Mr. S. Wellington—3rd Vice-President.

Mr. D. Gillen—Secretary.

Mr. R. T. Gray—Treasurer.

The Vice-President, in his address at the organization meeting held in Madoc, spoke as follows:

I can assure you I consider it a very great privilege to have this opportunity to speak to you this evening on a question that is of the deepest importance to this section of Ontario and this county in particular. We have met here to-night for the purpose of organizing two associations, both with the same object in view, the welfare of the community. And I do not think there is a gentleman here to-night, but is heartily in accord with the object of this meeting. I am not intending to speak altogether in the interest of the Board of Trade, only that I sincerely hope you will be successful in forming such an organization as at this time, more than at any other time in the history of Madoc, such an organization should be formed. But I would like to say a few words in behalf of the mining interest of Eastern Ontario. As we, the miners of this section, feel that the present mining laws and regulations are not adapted for this section, and that the legislation that has taken place is all based in the interest of the Cobalt section, and not for the older portion of the province. And we feel separate legislation should be made, so as to meet the wants of the eastern district. The conditions existing in this section, and the Cobalt section, are so far apart that the same laws and regulations cannot govern both districts satisfactorily. We also feel that nothing has yet been done by the present Government that has benefited in any way this portion of Ontario, not that they wish to discriminate against this section, but from their want of reliable information regarding our wants. And we feel that representation should be made to the Government, so that we may have our rights. This county is the premier mining county in Ontario, in fact, I might say in Canada. And although Cobalt is immensely rich in silver and we hope also in gold, yet as a matter of fact, there is as much or more wealth in sight at the present time in Eastern Ontario and in this county, than Cobalt will ever produce, and when Cobalt has gone the way of all such mining camps, Hastings district cannot fail to be a flourishing mining centre. I do not make this statement out of any doubt about the richness of that section, but I make it from the facts connected with our county. In the first place Cobalt, we know, has some enormously rich silver mines, but in that alone consists her wealth. When they are worked out nothing will be left. Now, what has this district got. In the first place, we have more arsenical ores in the County of Hastings and Addington, than can be found in any other country in the world, and with capital to develop their deposits, we could produce enough arsenic in this district alone to supply the world's demand. And I make this statement knowing what I say to be the fact, that in no part of the Dominion of Canada can such views of auriferous free milling quartz be found as in this county. In the northern part of these townships you can see veins from fifty to two hundred feet wide. At the Craig mine in Tudor there is a vein over three hundred feet carrying free gold. True, the ores are low grade, but all high enough to pay if worked on a large scale. Then there are iron deposits in every township in North Hastings, and no finer iron can be found in the Dominion than in some of the best iron deposits. Look at the mines at L'Amable, owned by Mr. Farham, for which he refused $2,000,000 within the last month. And what about our pyrites? In what part of this continent can they be found in such abundance as in this district. See what the Nickle's Co., of New York, are doing in the township of Hungerford—erecting a plant at a cost of over one million dollars, to treat the products of their own mines. Then we have copper. See what Col. Saunders has been doing with his copper smelter at Eldorado, and Mr. Cushman at Bannockburn, with his lead smelter. And besides these ores we have talc. soap-stone and marbles of every shade and color, sandstones, feldspar, mica, asbestos, actinolite, corundum, cobalt, plumbago, flourspar, lithographic stone, molybdenite zinc, sodalites, celestite, marells, antimony, barite, apatite, fowlerite, and pyrrhotites, besides quarries of granites, gneiss, slate and lime stones. And it is because we have these minerals that we feel some sort of assistance should be given, and we hope that this association will be the means to bring this district more prominently before the public. The question has been often asked why our gold mines have not paid. The question is easily answered. In almost every case it has been the want of money, the want of experience, the want of development, and the cost of power. This is not a poor man's country, it requires capital to develop our mines, and the ores must be treated in large quantities. With two exceptions the largest mills in this district are ten stamp mills. As a rule our ores will not go over $4.50 to $5.50 per ton, although these exceptions in gold, which even with ten stamp mills would pay well, provided we had cheap power. When I tell you that it cost the Gold Fields Co. in the neighborhood of $35,000 to $38,000 per year for fuel, over $80 per horse-power per annum, and the Atlas Arsenic Co., when working the Gawley shaft over $20,000 per year with only a ten-stamp mill, you can have some idea of where the profits go, but now that the Government has taken up the power question, there is no reason if we can get the power at a reasonable cost, but that any one of our gold mines will pay. Of course, we who are in the arsenical district are not depending on the gold product alone, as we have the arsenic as a paying product, and there is every reason to believe that the arsenic mine will be in full blast next summer, provided arsenic holds its present price. Two years ago arsenic was sold in New York at $60 per ton. Now it is worth from $140 to $160 per ton. With our supply of arsenical ores, and the fact that in England where the main supply came from, manufacturing arsenic is a thing of the past, on that account there is good reason to believe that the eyes of capitalists will be directed to this district. In fact, they have got to, as with our gold product which our mispickle ores contain, we can manufacture arsenic at a cost of $40 less per ton than they could do in any other country. It has also been said by skeptics who know nothing about the conditions of this section, that our pay ores do not continue with depth. I defy any one to show any truth in this statement. The fact is, that in every instance better values are found in the lower workings than on top. It is quite true we have no deep mines. The deepest shaft is on the Gold Fields' property at Deloro, which is in the neighborhood of 500 feet. The ore at this level is richer in arsenic and in gold, than was ever found on top. The same applies to the Cordova at its 400 feet levels, and also at the Gawley and Atlas arsenic mines, as well as at the copper mines at Eldorado, and lead mines at Bannockburn; also the Craig Co. mines in Tuar, and the richest and largest bodies of ore at the Nickle's property in Hungerford township, were found at these present workings between three and four hundred feet, and there has never been an instance on record where a true vein has pinched out in this section; so I may say that any statement of that sort is utterly misleading and untrue. Now, gentlemen, what do we want from the Government? We ask from the Dominion Government that no bounty be paid on pig iron which is smleted in part or in whole from American ores, but that a bounty be paid on iron manufactured from Canadian ores. That there shall be no duty on coal when used for smelting purposes. From the Ontario Government we ask that there shall be no licenses required for prospecting either on Government or private lands in this district; that the mining license system be done away with; that there shall be no bounties on gold ores that do not pay over $20 per ton. We also want that a full list of all the Government lands be placed in hands of the clerks of each township in this district where mine lands exist, so that those wishing to prospect Government lands may know the lots owned by the Government, and we ask that a tax of not less than 20c per acre shall be paid by owners on the mineral rights of properties who do not own the surface rights, and who are not working the properties. As you are aware, in this section thousands of acres are held by speculators who buy up these lands at tax sales. Selling the surface rights and holding the mineral rights for speculative purposes. By doing this the municipalities will get the benefit of this revenue, and they will either have to sell their properties at reasonable figures, or contribute to the revenue of the country. We would also ask the Government that an appropriation be made each year for assisting to build roads to mines that are situated in the unsettled parts of the county. We would also ask that assistance be given or a bounty paid for establishing reduction work for the treatment of pyrite ores, so as to encourage this industry in this section, where there are so many undeveloped pyrite properties. These questions with others on the same lines I hope will be brought up at our future meetings, and I am confident with our united efforts, we can show investors that there is no better field for investment than in this section.

QUEBEC'S MINING AREA.

The following communication has been received:

"While the Province of Ontario is selling the beds of Cobalt lakes for millions in cash, and so forth, the Province of Quebec is permitting speculators to take up vast blocks of the public domain, under "mining license," at five dollars a square mile. Recent discoveries in the Lake Chibougamau district have made it about as certain as anything in regard to mining can be, that this country is going to be a rich mining one, although the public has hardly realize that this is the case, and that we have in our own province a mineralized area, which, if it were served by a railway, would make Cobalt look like a pawnbroker's shop after a pledge sale. Already there is not an acre of rock or swamp in that district that a free prospector can go in on, for ten miles, at least, around Paint Mountain. When the railway is built, as built it must be in the near future, the prospectors must buy the rights to prospect from the gentlemen who hold the mining licenses, not from the province, and the minerals, when found, must be bought, not from the province, but from the same fortune miners, who mine by taking up blocks of, say, ten square miles by getting four lines drawn on an imaginary map, and paying fifty dollars. All this is to be the more regretted because the discoveries in the Chibogamoo district seem to be of such a nature as to lead to the belief that a very profitable, and what is better, a permanent mining industry will in time be established there. Free prospecting cannot now take place, and the indispensable railway cannot now be built with any hope that the mineral discoveries will recoup the expenditure, as must have been the case already in Ontario; for the returns from Cobalt (including the fees on company flotations), must have gone a long way towards paying for the Temiscaming Railway. One thing is certain, the mineral areas in the northern part of this province must be opened up by a railway, and that immediately. How it is to be done is a matter for the Government to decide. It has granted the licenses; it must face the music and the organ men it has fed so splendidly.

"QUEBECKER."

THE COBALT CAMP OUTPUT.

Cobalt ore shipments during the month of January, 1907. Period January 1st to January 12th, 1907:—

Jan. 3, G.T., 21,631, Buffalo Mine to Chas. L. Dennison, Perth Amboy, N.J., 59,000 lbs.

Jan. 4, G.T., 4,673, McKinley, Darragh, & Savage Mining Co. to Balback Smelting & Refining Co., Newark, N.J., 60,000 lbs.

Jan. 7, G.T., 7,802, Coniagas Mine to American Smelting & Refining Co., Perth Amboy, N.J., 62,700 lbs.

Jan. 7, G.T., 9,037, Coniagas Mine to American Smelting & Refining Co., Perth Amboy, N.J., 54,800 lbs.

Jan. 9, C.P., 44,838, Green Meehan to Canada Copper Cliffe, Ont., 61,210 lbs.

Jan. 10, P.R.R., 14,681, O'Brian Mine to American Smelting & Refining Co., Perth Amboy, N.J., 103,000 lbs.

Jan. 10, G.T., 29,806, Nipissing Mining Co., Nipissing Mining Co., New York, N.Y., 40,100 lbs.

Jan. 11, Soo, 25,386, O'Brian Mine to Canada Copper Co., Copper Cliffe, Ont., 64,866 lbs.

Jan. 12, Soo, 18,498, O'Brian Mine to Canada Copper Co., Copper Cliffe, Ont., 64,795 lbs.

Period January 20th to January 26th, 1907.

Jan. 21, N.D., 20,596, O'Brian Mine, Canada Copper Co., Copper Cliffe, Ont., 60,570 lbs.

Jan. 21, G.T., 6,142, Coniagas Mine to American Smelting & Refining Co., Perth Amboy, N.J., 56,720 lbs.

Jan. 21, C.P., 40,870, Cobalt Townsite Mining Co. to Orford Copper Co., Copper Cliffe, Ont., 47,160.

Jan. 22, G.T., 27,309, Buffalo Mine to Chas. L. Dennison, Perth Amboy, N.J., 40,000 lbs.

Jan. 23, G.T., 2,311, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 41,730 lbs.

Jan. 23, L.V., 8,953, University Mine to University Mine, c/o Leeoux Co., New York, N.Y., 61,385 lbs.

Jan. 23, C.P., 24,558, Cobalt Silver Queen Mining Co. to Canada Copper Co., Copper Cliffe, Ont., 38,860 lbs.

Jan. 23, C.P., 147,942, Cobalt Silver Queen Mining Co. to Canada Copper Co., Copper Cliffe, Ont., 86,823 lbs.

Jan. 24, G.T., 25,479, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 40,400 lbs.

Jan. 24, G.T., 24,135, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 42,047 lbs.

Period January 28th to February 2nd, 1907.

Jan. 29, G.T., 3,413, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 60,460 lbs.

Jan. 29, G.T., 13,453, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 60,394 lbs.

Jan. 30, G.T., 14,413, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 61,450 lbs.

Jan. 30, G.T., 28,886, Buffalo Mine, American Smelting & Refining Co., Perth Amboy, N.J., 40,000 lbs.

Feb. 1, G.T., 25,365, Nipissing Mining Co., Nipissing Mining Co., New York, N.Y., 40,180 lbs.

Making a total for this period of 262,484 lbs.

CANADIAN MINING INSTITUTE, ANNUAL MEETING.

The Ninth Annual Meeting of the Canadian Mining Institute, will be held at the King Edward Hotel, Toronto, on March 6th, 7th and 8th, 1907.

The usual single fare rate will obtain over all Canadian transportation lines.

The King Edward Hotel also offer a special reduced rate for members and others attending the meeting.

An interesting programme of papers has been arranged.

Members will be good enough to notify the Secretary as early as possible of their intention to attend.

The Nominating Committee submit, (in accordance with Par. XXVII., Sec. V, of the By-Laws), the following list of nominations to offices falling vacant at the end of the next Annual Meeting.

President—Mr. Frederic Keffer, M.E., Greenwood, B.C.

Vice-Presidents—Dr. J. Bonsall Porter, Montreal, Que.; Mr. W. G. Miller, Toronto, Ont.; Mr. W. Fleet Robertson, Victoria, B.C.

Secretary—Mr. H. Mortimer-Lamb, Montreal, Que.

Treasurer—Mr. J. Stevenson Brown, Montreal, Que.

Council—Mr. E. W. Gilman, Montreal, Que.; Mr. Jas. McEvoy, Fernie, B.C.; Mr. Frank B. Smith, Edmonton, Alta.; Mr. R. W. Brock, Ottawa, Ont.; Mr. J. C. Gwillim, Kingston, Ont.; Dr. F. D. Adams, Montreal, Que.; Mr. H. E. T. Haultain, Craigmont, Ont.; Mr. David H. Browne, Copper Cliff, Ont.

BOOK REVIEWS.

Bulletin No. 28 of the Institution of Mining and Metallurgy, London, E.C., England, has been received. It is replete with papers of interest to mining engineers and metallurgists.

The production of gas, coke, tar and ammonia during 1905 in the United States is given in a pamphlet just issued by the United States Geological Survey. The author is Edward W. Park.

"Land Smelting and Refining, with Some Notes on Lead Mining," is the title of a work that has been issued from the press of the Engineering and Mining Journal, New York. It is a reprint of various articles pertaining, especially, to the smelting and refining of lead together with a few papers bearing on mining of lead ore, taken from the pages of the Engineering and Mining Journal, together with others that have appeared in the Transactions of the American Institute of Mining Engineers. The editing has been done by Dr. W. R. Ingalls, whose intimate acquaintance with this branch of metallurgy, is, of course, well known. The book will be found a most useful work of reference by those having to do with either the smelting, refining or mining of lead ore. The price is $3.00.

The following reports and catalogues have been published by the Geological Survey since January 1, 1906:—

No. 913. The Mineral Pigments of Canada. By C. W. Willmott ((pp. 39). Published February 18, 1906.

No. 914. Supplementary List of Publications during 1904 and 1905 (pp. 11). Published February 20, 1906.

Mineral Production of Canada for 1905 (pp. 16). Published March 15, 1906.

No. 939. Preliminary Report on the Rossland, B.C. mining district. By R. W. Brock (pp. 40). Published June 2, 1906.

No. 923. Report on Chibougamau mining region. By A. P. Low, (pp. 61).

No. 940. Report on Graham Island, B.C. By Dr. R. W. Ells (pp. 46). Published July 20.

No. 888. The Geology and Petrography of Mount Yamaska. By G. A. Young, forming Pt. H. Annual Report, Vol. XVI (pp. 43).

No. 955. French edition of 923 (pp. 57). Published August 2.

No. 947. Summary Report of the Acting Director, for 1905 (pp. 144). Published August 31.

No. 950. Palaeozoic Fossils, Vol. III., Part IV. (and last). By J. F. Whiteaves (pp. 208). Published October 10.

No. 956. Catalogue of Publications (pp. 129). Sent to printer June 11. Signed for printing September 21. Published October 12.

No. 907. Annual Report (New Series), Vol. XIV. (pp. 1193).

No. 911. Annual Report (New Series), Vol. XV., (pp. 1025).

No. 905. "Cruise of the Neptune." By A. P. Low (pp. 355). Published November 19, 1906.

No. 928. Section of Mines, Annual Report, 1904.

The following reports are going through the press:—

No. 902. Report of Brome Mountain, Que. By J. A. Dresser.

No. 942. Report on the Upper Stewart River, Yukon. By J. Keele, and

No. 943. On the Peel and Wind Rivers, Yukon. By C. Camsell.

No. 952. Annual Report (New Series), Vol. XVI., (pp. 733).

No. 958. Annual Report on Chemistry and Mineralogy. By G. C. Hoffmann.

No. 949. Cascade Coal-field. By D. B. Dowling.

No. 961. Reprint of Report on Nickel and Copper Deposits of Sudbury district, Ont. By Dr. A. E. Barlow.

No. 962. Reprint of Report on the Nipissing and Timiskaming region, Ont. By Dr. A. E. Barlow.

The British Columbia Bureau of Mines has issued Bulletin No. 1, 1906, describing the mineral claims on the West Coast, and in the vicinity of Great Central Lake, Vancouver Island. It was written by the Provincial Assayer, Mr. Herbert Carmichael. The groups described are those of the June, and Yreka, and the hematite ore deposits of Quatsino Sound; the Marble Quarry, Stormont, Glengarry, and Texas, on Nootka Sound; Hesquiat Harbour, Indian Chief, and Prince Group on Sidney Inlet; Ormond, near Matilda Creek, Pete and Iron King, Copper King, Nos. 1, 2, and 3 and Ormond No. 2, near Ahousat; Good Hope, Killapa, American Wonder, and Hetty Green, of Clayoquot Sound; Red Rover, Enterprise, Sarita Group; Cascade Southern Group; Happy John Group; Monitor, The Nahmint, Gladys and Edith Group; on Barkley Sound. In addition, the Great Central Lake district is described. It is reached from the town of Alberni by waggon road, 12 miles long; the lake being 200 feet above the sea.

The general trend of the lake is east and west, and it is about twenty-five miles long by a mile or so wide. At its western end two creeks flow in, heading from mountains still farther west. A trail from the lake follows the most northerly of these creeks on a gradual ascent for a distance of ten miles, until it ends in a basin, shut in by high mountains, the basin having here an elevation 1,500 feet above the Great Central Lake, or 1,700 feet above the sea. To the south a precipitous bluff rises 2,075 feet high, from which pours a considerable stream of water that barely touches the rocks until it reaches the bottom, breaking into a mass of spray in its descent. The ascent of the bluff requires stout muscles, and the aid of the small bushes which cling so tenaciously to the clefts in the rock. On the top there is a small rocky plateau, or basin, enclosing a lake about half a mile long by a quarter wide, the elevation of the lake being 3,350 feet above the sea. The mountain lake, situated in the heart of Vancouver Island, with snow-clad mountains rising 2,000 feet above it, and the blue crevassed glacier of the "Nine Peaks" showing up to the south in the morning sun, forms a beautiful scene.

Big Interior Group: This group consists of seven claims, viz.: Big Interior, Nos. 1 to 7, and was located by Drinkwater and Nicholls, of Alberni. The claims are reached from the head of the small lake referred to, by following up a small second basin, about a quarter of a mile. The head of this second basin is hemmed in on three sides by precipitous cliffs a thousand feet high, on which rests a snow cap, terminating in peaks which are 2,000 feet above the lake below. Practically, this entire face, some 4,000 feet wide by 1,000 feet high, shows the strong red color due to iron stain, while at the base there are thousands of tons of the same rock which have been mined by the action of elements. A closer examination shows this cliff to be a granitoid rock, mineralized with copper pyrites, pyrrhotite, and pyrite in varying proportions, some zones showing strong mineralization, while in others it is more sparse. To the west the rock assumes a brecciated structure and has been cemented together by a filling of calcite, with a considerable impregnation of copper carbonates, and into this zone a tunnel has been driven a distance of 31 feet. The ascent of the bluff is somewhat dangerous, owing to the rather precarious foothold, and the absence of vegetation, the top being reached at an elevation of 1,375 feet above the small lake. From the top of the bluff a snowslide was followed until a further elevation of 500 feet was reached, at which point the ore is uncovered, and shows the strongly mineralized granitic mass which is seen to penetrate a nearly horizontal strata of limestone, alternate bands of which continue to the top of the mountain 500 feet still higher. This sharp ridge, with its altitude of 5,700 feet, may be considered as the backbone of Vancouver Island, shedding the water to the south down the Alberni canal, to the northeast down Buttle Lake and the Campbell River, and to the west of Bear River into Clayoquot Sound.

The mineralized zone, showing in the face of the cliff to the north of the basin, and forming the great mass of low grade mineral on the property, is so large, so inaccessible, and the mineralization so scattered, that it would be impossible to obtain anything approximating an average general sample of the exposure without the expenditure of an amount of time and money not justifiable under the circumstances. However, at the foot of the cliff, there is a talus extending the whole length or width of the mineralized zone, made up of material broken away from the whole face of the zone in question. While this talus may to a certain extent have been affected by weathering, it still may be considered a very approximate sample of the inaccessible cliff. Samples were taken from this talus, from which it is judged that approximately the central portion of the mineralized zone will assay from ½ to 1 per cent. copper, with 1½ to 2 oz. silver per ton, and a trace of gold. These values extend over a width of about 1,500 feet, while to the right of the mineralization gradually fades off into the country rock.

To the left of the mineralized zone is what has been called, for purposes of designation, the "brecciated zone," and which is merely a continuation, to the left, of the mineralized zone which has been subjected to a crushing due to movement and in which the interstices between the fragments of the rock have been filled with secondary minerals, chiefly calcite, with some carbonate of copper, forming a secondary enrichment. This secondary enrichment has taken place, as would be expected, along defined channels, producing streaks of higher grade mineralization often forming commercial ore. Here, again, no general sampling was possible; although a tunnel has been driven for some 31 feet into the bluff, it was found impossible to examine the face of the cliff for 10 feet on either side of the tunnel mouth.

The mineralization just described, and which forms the great bulk of visible mineralization on the property is admittedly very much diffused through the rock, and is consequently so low grade as to be of value only if found to be amenable to some form of concentration, and of which there seems to be a fair probability.

On the top of the mountain, is an area in which the mineralization seems to be more concentrated, producing, in places, ore of a grade to stand transportation and treatment charges. This higher grade ore appears to occur along the lines of contact of alternating bands of granitic rock and limestone. The extent of the latter deposit it was found impossible to determine, as the ore was found to be covered in most places by a heavy capping of gossan, and in many places seemingly permanent snow and ice covered up the formation. While the future of the property is far from being proven, the very great extent of the mineralization, with occasional concentrations, certainly renders the proposition worthy of most careful investigation and prospecting.

Della and Glacier: These claims are situated on the small lake in the Big Interior Basin, and are owned by Drinkwater and Engvik. On the claims is a small quartz vein from 2 to 3 feet wide, mineralized chiefly with arsenical iron. Assays of the straight ore gave the following result:—Gold, 5.12 oz. per ton; silver, 5.2 oz. per ton; copper, 1.0 per cent. The vein has not yet been worked to any extent, but an attempt has been made to extract the values by roasting the ore and grinding in an arastra, which has been erected and is being run by a small waterwheel constructed on the ground.

An examination of the different properties on the west coast of Vancouver Island, especially those on which extensive development work has been done, would point to the following theory as to the mode of ore deposition.

The properties, with the exception of those in Quatsino and Great Central Lake, present nearly identical conditions. The mineralization occurs in or close to diabase dykes. Sometimes there is sufficient quartz in the fissure to make a quartz vein, but more often there is an entire absence of quartz, the vein-matter being the crushed material of the dyke. There appears to have been two periods of movement, the first in which the dykes have formed, when no mineralization took place; the second period in which these dykes were scattered and twisted, when probably secondary dykes of a similar composition to the first series were injected into the fissures found by the movement.

A careful examination of these deposits would lead one to the conclusion that mineralization took place at this time, not as a secondary enrichment, but as a direct deposit by ore-bearing solutions from below. The solid mineral is seen to penetrate what were originally cavities. and to follow along old slip-walls, inside of which, as a rule, no mineral whatever is seen, as would be the case if segregation had occurred. The deposits are often brecciated structure, the ore enclosing fragments of the original dyke-rock, and only occasionally is it seen forming a part of the dyke, and then it would be accounted for as forming part of the second upheaval when the later dykes were formed. Mineralization is found along fractured zones in these diabase dykes, and where these fractures contained cavities for the entrance of mineral-bearing solutions we now have ore-bodies, but where the ground is tight or shows only slight movement little or no ore is found.

Chalcopyrite froms the principal mineral of value, while pyrrhotite is a common mineral, occurring both massive and mixed with pyrite and chalcopyrite, but carrying little or no value in itself. Arsenopyrite occurs in any of the properties, and, as a rule, carries gold values.

While no geological map or extensive examination of this region has been made, the general country rock outside of the mineralized zones appears to be syenite, occurring often as mountains of great size and connected with a series of feslpathic dykes which penetrate the older rocks.

PERSONALS.

Mr. A. A. Talmage has become associated with the Pittsburg-Salt Lake Oil Company, his headquarters being in the Chamber of Commerce Building, Los Angeles, California.

On the evening of January 30, a supper was given to Mr. W. A. Duff, assistant manager of the Canadian Westinghouse Company, Limited, on account of his leaving Montreal to take the position of manager of the Canadian Westinghouse Company's office in Winnipeg.

On Feb. 6, about 60 or 70 members of the Ontario Legislature visited the School of Mines at Kingston, going by special train from Toronto. The School of Mines has asked for an increased grant, and the management were desirous that the members should see the work being done.

Mr. Robert R. Hedley, M.E., has resigned his position of manager of the smelter of the Hall Mining and Smelting Company, Ltd., Nelson, B.C.

Thomas A. Nevins, head of the banking firm of Thomas Nevins & Son, and a party of New York, Philadelphia and Pittsburg capitalists, have been in Cobalt inspecting properties.

Samuel Newhouse, E. P. Earl, W. B. Thompson, and Eugene Meyer, who have been inspecting the Nipissing properties, returned to New York at the beginning of the month.

Col. J. H. Robeson, a mining man of Denver has been secured by President Newhouse as manager of the Nipissing property.

Dr. J. J. Deadman, manager, and Fred. R. Price, secretary of the Abitibi Mining Company, have been in Toronto.

Mr. Geo. S. Wynne has been appointed acting general manager of the Lake Superior Corporation in place of Mr. Sawyer, who has returned to Pittsburg.

MINING NOTES.

A French writer says:—All the known deposits of platinum are becoming exhausted, and the price is going up to a prohibitive extent. In 1876 the metal could be bought for $100 the kilogramme. Four years later it had doubled; in 1901 it had quadrupled, and to-day the price is $1,200 per kilogramme, or twice the price of gold. Even that is for crude platinum. The worked metal is twice as dear again. Considering how many industries are now absolutely dependent upon platinum, the question of replacing it by some really efficient alloy or combination is acquiring vital importance.

NEWFOUNDLAND.

Valuable copper mines, covering an area of nearly a square mile, and situated at St. John's, Nfld., were a few days ago purchased from Messrs. Kawaja Bros., and the other two shareholders, by Mr. T. H. Ryan, representing a number of New York capitalists. The purchase price was $75,000. Sir E. P. Morris, of St. John's, who represented the North Sydney shareholders, transacted the deal. The property is said to be the most valuable of all the many copper areas in the Ancient Colony.

NOVA SCOTIA.

The development work which has been going on at Barrachois for the past few months has resulted in the exposure of an eighteen foot seam of iron ore. The operations have been carried on under the direction of W. F. Jennison, C.E., who leased the areas some months ago.

Samples of the ore were sent to Sydney Mines for analysis. The report from there was that the ore was of an A1 quality, and suited for the purpose of mixing with the Wabana ore in the manufacture of Bessemer pig.

QUEBEC.

Our esteemed contemporary, the Gazette of Montreal, had an editorial on Superintendent Obalski's report for 1905, in its issue of January 31. Better late than never. Yet the readers of the Mining Review read a resume of it in our July issue. The Gazette was more belated than the report.

ONTARIO.

Mr. E. J. Donn has been around Larder Lake for years. Mr. Donn states that about 1,500 persons are now living around the lake, and that about 2,000 claims have been staked.

Native silver is said to have been found forty miles up the Montreal River, in a location about twenty miles distant from Cobalt. It is stated that, in view of this find, the possible silver-bearing lands will be included in a block about twenty miles square.

Mr. Aubin, M.P.P. for West Nipissing, is authority for the statement that there is considerable activity in copper mining around Sturgeon Falls. Prospectors are going in by the dozen and rich veins are being discovered. A short time ago an area of some 480 acres was sold for $300,000.

This week we are able to announce the formation of the "Hugo Von Hagen Exploration Company," with an authorized capital of fifteen million dollars, being divided into three million shares of five dollars each, three-fifths of which are treasury stock, says the Wabigoon Star. This company has secured 51 per cent. of the stock of the Laurentian Gold Mines, Ltd., besides controlling interests in various other incorporations.

Mining Recorder Smith at Haileybury says remarkably rich specimens have been shown him as coming from Larder Lake.

From what can be gathered of the district generally, it would appear that it holds possibilities of becoming an important mining camp. Whether its future is good or bad, there is no doubt but that the district will be invaded this coming summer by a large number of prospectors.

A company has been organized to operate a mine discovered some time ago along Sturgeon Lake, in the Sturgeon Lake gold field district. The mine is reached from St. Ignace, and is 150 miles west of Port Arthur. The company will be known as the Douglas Mining Company, and will have a capital of $500,000. The directors will be Messrs. G. S. Gzowski, John Douglas, J. A. Gaggett, Geo. Laird, Toronto, and James Atwood, of British Columbia.

For the year 1906 the revenue of the Ontario Bureau of Mines reached a total of $250,090. This sum included the first royalty ever collected by the province from those engaged in the development of mineral deposits. This payment, amounting to $15,000, was made by the holders of the O'Brien mine, on a carload of ore shipped in 1905, subject to the outcome of a lawsuit then pending. Later, the action was abandoned, and the O'Briens agreed to pay a royalty of 25 per cent. of the value of the ores mined. The aggregate also includes the sum of $108,500, the 10 per cent. payment made on the acceptance of the tender for the purchase of Cobalt Lake. Miners' license fees netted the province $70,000.

In 1905, the receipts reached a total of $61,560, while the appropriation made by the Legislative Assembly for the Bureau of Mines, including salaries for the staff in the office and in the field, and a vote of $25,000 for work in the Gillies limit, was $86,950. The revenue thus exceeds the year's expenditure by $163,140.

At the annual meeting of the Nancy Helen Mines Company, Messrs. W. R. Smyth, M.P.P., Wm. Black, and J. F. Black were respectively re-elected president, vice-president and secretary-treasurer. The reports presented were of a most satisfactory nature. Some work has been done on the 40-acre claim in Bucke township, owned by the company, and it gives promise of being a fine mining property. On the company's mine in the town site of Cobalt work has been and is being steadily continued. This property is numbered among the shipping mines of the district. A shaft has been sunk 82 feet and three carloads of ore are now awaiting shipment. A plant and

Westinghouse Exhibit at St. Louis.

equipment costing $20,000 is being installed, in fact, some of it is already in place. Several new and most promising veins have been discovered on this property quite recently, besides those now being worked. Among mining men in the Cobalt district the company's properties stand high and there has been considerable inquiry of late as to whether the company will make a public issue of stock. The company, it is said, intends to adopt this course some time in February.

A new mining district in Northern Ontario, which threatens to rival the far-famed Cobalt camp, is opening up in the Sutton Bay country, situated in Harris Township, lying eight miles east and one mile north of the town of New Liskeard. The new camp is commonly called the Casey mountain range, and at the present time of writing the showing prognosticates wonderful things for the future of the Casey mines.

The Casey mountain region is identical with Cobalt in formation. The same lower Huronian conglomerate with diabase contact is found to permeate the district, which lies on the edge of a swamp or the former level of Lake Temiskaming in pre-historic times.

The mountain range rises to a considerable altitude and runs east one and one-half miles, and has all been claimed. Native leaf silver in fairly large quantities has been found, and the two mining companies already operating are very much encouraged and expect to run into pay ore within a short time.

The companies operating are the Cobalt Silver Crescent Mining Company and the Bucknell Mining Company. The Silver Crescent Company is in charge of Herbert Murray, a mining engineer of large and varied experience, which has been gathered in California and at Nome, Alaska. Mr. Murray is of a conservative temperament, but even this trait does not prohibit him talking enthusiastically regarding the future of the Casey mountain range. At present the Silver Crescent Company has fifteen men working on the claim, busily engaged in cross-cutting and sinking a shaft to catch several veins of great promise. The several fissures are 4 or 5 inches wide, and carry cobalt ore and native silver. The decomposed cobalt bloom on one of these veins is as fine, if not better, than any in the Cobalt district farther south. The Silver Crescent Company has a nicely equipped camp, and in the early weeks of spring, machinery will be established for working the mine. The Cobalt Silver Crescent Company has a capital of $500,000, divided into dollar shares, and Pittsburg magnates are largely interested in the proposition.

The Bucknell Mining Company, next to the above claim, is working twenty-five men. They are just now erecting an engine and boiler-house, preparatory to establishing an up-to-date plant. A shaft has been sunk 40 feet on the property, and drifting from this centre 60 feet has transpired. The vein followed has a good showing of smaltite, or cobalt, ore and native silver, and recent assays promote confidence for the future in a large measure.

The Casey mountain range is two and one half miles from White River, a waggon road making transportation easy and quantities of wood and water abound for mining purposes.

COBALT.

The last car shipped from the Foster mine will, it is said, run over $58,000. "This is the richest yet shipped," says General Manager Adler.

It is rumored on the street that the negotiations in connection with the amalgamation of the Peterson Lake Company and the Nova Scotia are about completed.

The Nancy Helen Mines Company, which owns forty acres in Bucke Township, reports that a shaft has been sunk 82 feet, and that three car loads of ore are ready for shipment. A plant costing $20,000 is being installed.

The Coniagas people have commenced work on a 5x7 shaft in the Imperial Bank lot opposite the Prospect Hotel. There is known to be under the butcher shop to the north an important vein of ore, and it is the intention of the Coniagas to crosscut to this.

It is reported that McKinley-Darragh-Savage has declared a dividend of 2c monthly, equivalent to 24 per cent. per annum, on its 2,500,000 shares of $1 par value. No official announcement of a dividend has, however, yet been made, and local interests say they have not heard of it yet, though the mine has made some exceedingly rich shipments lately.

A report to Green-Meehan directors has just been received from Mr. C. A. O'Connell, manager, in which he gives the following figures: Number of days worked 53; average number of men employed, 35; number of tons of ore extracted, 47; actual cost of producing ore, $4,349.62; actual cost of production, per ton, $92.55; estimated value of ore shipped, $87,340.

Word has been received from Cobalt that an effort is being made to induce the settlers there to remove to Upper Cobalt, on Lake Temiscaming, a distance of about one and a half miles from the present site. The advantages of the new situation are that the site is much better, being on a gentle declivity, which slopes down to the lake. More sanitary conditions obtain, and good water can be secured. Upper Cobalt, it is also claimed, can be converted into a good summer resort.

Two shafts have been sunk on the eastern shore of Cobalt Lake by the Cobalt Lake Mining Company and calcite bloom has been discovered and some free silver obtained.

The draining of the lake will not be proceeded with for some time. The town of Cobalt, it is thought, might protest against the cutting off of the supply of water for fire protection purposes.

The proposition is to empty the lake by means of syphons and pumping plants.

At the second annual meeting of the Silver Leaf Mining Company, held January 30, in Toronto, the following were elected officers and directors for the ensuing year: President, Mr. A. G. Browning, North Bay; treasurer, Mr. A. E. Osler, Toronto; managing directors, Messrs F. B. Chapin and Frank Culver; directors, Messrs. S. C. Smoke, Toronto; Geo. L. Walker, Boston; John R. Stanton, New York; J. H. Rice, Houghton, Mich.; W. S. Pickett, Michigan, and Mr. Wm. D. Elwell, Boston.

Mr. E. T. Corkhill, provincial inspector of mines, Toronto, has returned to Toronto from the Gillies limit, where he has had charge of the operations of the government mining party.

He reports that work on the discovery reported some time ago is progressing steadily at the seventy-foot level, and that the ore body is showing up splendidly. In reply to a question as to whether they were shipping yet, he said that it had not been decided to do so yet, although they had lots of rich ore on the dump ready to do so. He states that all indications point to a great rush of prospectors into the Larder Lake district, when the spring opens.

A contract was signed recently between the financial agents of the Central Mines Company, Messrs. Thomas Nevins & Sons, and the Traylor Engineering Company, under which the latter is to supply the complete equipment for a 100-ton concentrator for the Cobalt-Central properties. This will be the first concentrator to be built in the Cobalt region. The crushers, rolls, rigs, concentrating tables, power house and elevators will be shipped as speedily as possible. The plant will enable the company to ship concentrates that will run high in silver. The company will also be able by this means to get full value for its shipments, as it will be able to carefully sample the same and know the average value before they are shipped, which is not possible to do on any shipments made from Cobalt as matters stand to-day.

R. Meeks, in The Engineer and Mining Journal, makes the following statements in a write-up of Cobalt:

It may be of interest to mention the final disposal of the ore from this district. While there are rumors of a smelter being built near the mines for the treatment of their ores, still, so far as can be ascertained, they are only rumors. Experiments are being conducted at Hamilton, Ont., which are said to be successful, and, moreover, it is claimed that mine-owners of Cobalt are financially interested in the venture. But at present all the ore is treated in three smelters, and must be hauled a long distance, and at considerable cost,

From the correspondence which I saw at Cobalt, the following smelter charges were derived: The American Smelting & Refining Company agrees to pay for 94 per cent. of the silver contents, and charges a flat rate of $10 per ton. The terms are cash immediately after the agreement of assays, and no payment is made for nickel, cobalt, or arsenic values. The matte containing the nickel and cobalt becomes the property of the smelters, and it is claimed that this is shipped to Saxony, Germany, for treatment. The shipper must also pay a sampling charge of from $5 to $6 per ton, and the freight charge, which amounts to $10.20 per ton. This charge is divided as follows: From Cobalt to North Bay, $3.20; from North Bay to New Jersey points, $7.

The Balbach Smelting & Refining Company of Newark, N.J., has a sliding scale, as follows:

Ore containing 400 oz. silver, $6; 400-500 oz., $5; 500-600 oz., $4; 600-700 oz., $3; 700-800 oz., $2; 800 oz., or more, no charge.

They agree to pay for 93 per cent. of the silver contents at New York market prices on the day of contract, settlement to be made 14 days after agreement of assays, or 1 per cent. less for cash. In this case, also, the shipper pays for sampling and freight charges as before.

Corroborated particulars relative to the charges made by the Canadian Copper Company, at Copper Cliff, were not available, but they are said to be as follows: The smelter makes no charge for smelting or sampling, and agrees to pay for 93 per cent. of the silver contents at market rates, and also agrees to pay for cobalt, providing it is in excess of 15 per cent., and that the nickel values are low. The freight charge to this smelter from Cobalt is $5.20, or practically one-half that charged to New Jersey. There is, besides, a direct saving of $5 to $6 for sampling, depending upon the value of the ore. In some districts a freight and treatment charge of possibly $25 per ton would be the determining factor between profit and loss.

BRITISH COLUMBIA.

The management of the Jumbo mine have decided to expend $75,000 in working this property, and the mine will be opened by a shaft of several hundred feet depth.

The total shipments of Rossland ore for 1906 were 277,361 tons, which is less than in 1905. The falling-off is due to a strike of the employees of the Crow's Nest Coal Company. At an estimated value of $12 a ton, the total output is worth $3,338,332. Since 1894 the total output has been 2,592,254 tons, valued at $36,728,480. The best shippers last year were the Le Roi and Centre Star which produced 126,396 and 114,500 tons of ore respectively.

On the White Bear mine drifting and diamond drilling has been done on the 800-foot level, and drifting and cross-cutting has been kept up on the 700-foot level. There has also been drifting on the 1,000-foot level. The most important find was made on the 700-foot level, when a shoot of ore 20 feet wide, and of good grade, was uncovered. About 1,350 tons of second-class ore has been run through, the plant producing 1,350 tons of concentrates. During the year 570 tons of raw ore were shipped.

The reports for the year show that the Central Star and its allied mines have much improved. The holdings of this company were increased by the purchase of the Idaho and the Iron Mask properties. The workings of the Iron Mask have been connected with those of the War Eagle and Centre Star by drifts and cross-cuts, which makes it possible to bring its ore out above its 450-foot level through the connections made between the 400-foot level of the War Eagle and the 350-foot level of th Centre Star. Considerable surface work has been done on the Centre Star, and its related properties and a large crusher having a capacity of 1,000 tons a day, and a 700-horse power motor have been installed. About 350 men are employed.

On the Le Roi mine is a staff of 325 men. A cross-cut has been driven through the dike, which runs across the western end of this mine, and ore bodies of good grade have been discovered on the west side of the dike. The western section has been opened on 800, 900 and 1,000 feet levels, and the workings have been extended 250 feet west of the dike. About half the tonnage which is now being shipped is from this portion of the mine. The explorations at the 1,200-foot level have resulted in the finding of a good shoot of ore, and by extending a winze from the 1,350-foot to 1,750-foot level, large ore bodies have been revealed. A contract has been let to sink the main shaft down below the 1,350-foot level.

The gross shipments of ore from the Le Roi-Tevo mine were 21,000 tons; of a gross value of $24 per ton, and the concentration milled 10,500 tons of second-class ore at a value of $3.50 per ton. The concentrates were worth from $25 to $30 per ton.

COAL NOTES.

The approximate output and shipments for the month of January of the Dominion Coal Company were as follows: Output, 252,108; shipments, 165,215.

One thousand union men went out on strike on February 4, at No. 3 colliery of the Nova Scotia Steel Company at Sydney Mines. The men refuse to work with non-union men, of whom there are about one hundred employed at the mines. The trouble, which has been brewing for some time, is purely between the men themselves, the company having absolutely nothing to do in the matter. For some time the union men have been trying to induce their non-union friends to join the association, but without success. At a meeting of the Pretoria Lodge, held on Saturday night, it was decided to quit work on February 4, in the event of their demands not being acceded to. All the prominent P.W.A. officials are now on the spot. The mine has been closed down.

General Manager Brown, in an interview stated that, for his own part, he did not think the company would interfere in the matter. The company cannot compel any man to join the union. They must treat all employees alike. On the other hand, the miners claim the company must discharge the non-union men or close down the mine.

The P.W.A. held a session of their lodge from 1.30 this afternoon until 10 o'clock to-night, when the entire situation was considered.

Nothing could be learned as to the conclusion reached. as it was decided not to divulge anything until to-morrow.

The Nova Scotia Steel Company has a large quantity of coal banked.

THE MINING AND INDUSTRIAL SHARE MARKET.

(Specially reported for the CANADIAN MINING REVIEW by ROBERT MEREDITH & Co., Mining Brokers, 57 St. François Xavier St., Montreal.)

Active interest in mining shares has not yet become evident, the market has been dull all the month for mines as well as other securities. The monetary situation and great congestion of general trade, is no doubt to a considerable extent responsible for the condition, but there is evidence that with the advent of spring active operations will be commenced in many camps, and it is probable that the production of precious metals this year will far exceed any previous one in the history of the Dominion.

In industrial shares the same condition prevails, and while most of the companies are showing good returns and doing a profitable business, the demand for the stocks is limited, and in consequence prices are irregular.

The latest quotations are as follows:—

	Bid.	Asked.
Consolidated Mines	135	140
Can. Gold Fields	6¼	7¼
Granby Consolidated	139	140½
Rambler-Cariboo	25	27½
North Star	10	20
Monte Christo	2	3
White Bear	8½	10
California	4¼	6½
Virginia	6½	8
Deer Trail	...	2
International Coal	60	63½
Sullivan	7½	9
Cariboo-McKinney	3½	4½
Denoro	10	15
Diamond Vale Coal	33	35
Alberta Coal and Coke	30	32
Dominion Copper	6¾	7
Novelty	2½	3½
Nipissing	11¾	12
Foster	2¼	2½
Silver Queen	2⅛	2¼
Trethewey	1⅝	1⅞
Kerr Lake	4¼	5¼
Silver Leaf	20	20½
Green-Meehan	140	150
Peterson Lake	50	51
Dominion Coal (com.)	6½	63
Dominion Coal (pref.)	...	...
Dominion Iron & Steel (com.)	21	21¼
Dominion Iron & Steel (pref.)	56½	59
Intercolonial Coal (com.)	...	...
Intercolonial Coal (pref.)	...	...
Nova Scotia Steel & Coal (com.)	69	70½
Nova Scotia Steel & Coal (pref.)	...	...

INDUSTRIAL NOTES.

Messrs. F. H. Hopkins & Co., are sending out a very artistic postcard, showing the 1907 model Ransome concrete mixer in operation.

The Gutta Percha and Rubber Manufacturing Company, of Toronto, Limited, state that their company is not in any way, shape or manner, a part of, or connected with any rubber merger or trust.

That more gold lies in the bosom of that far-north country than has ever been brought out of it is a fact which the public, in its usual carelessness, seems to have lost sight of completely. It seems to think because there's no more mad rush, there's no more gold.

But there are men here and there who are not content to let the precious metal stay up there any longer than they can help. One of the firms actively interested is The Yukon Consolidated Goldfields Company, Limited. Believing that the best aid they can have up there is electricity, they have purchased a large supply of apparatus from The Canadian Westinghouse Company. They will use this apparatus in dredging.

There is no doubt that electric power will be the most effective and least expensive in the end. And the operations of this company will be watched with interest.

The phenomenal growth of the use of concrete construction during the past two years has carried with it an equally augmented demand for finely crushed stone.

A few years ago the "screenings," a product of a stone crushing plant of a size of ¾ in. and less, was considered waste, while in a great many localities there is now the greatest demand for this size of product. Finely crushed stone is required for many purposes for which it was formerly considered unsuited.

In order to meet this new demand for finely crushed stone, the Allis-Chalmers Company, represented in Canada by the Allis-Chalmers-Bullock, of Montreal, has designed for the Gates Rock and Ore Breaker a short type of head and concaves, by the use of which the desired product may be obtained. An illustrated bulletin on this subject is now in preparation in which it is shown that the builders have not departed from the accepted standards of the Gates Breaker, the only changes being a simple substitution of the crushing parts. With the short head and concaves, the head is made shorter and of larger diameter than in the case of the standard length head.

This type of breaker has been used with excellent success when a fine product is desired from the machine, and when the stone fed into the breaker is of a comparatively small size.

It has also been used to equally good advantage as a rejection crusher when a fine product is desired and when the stone fed in is principally slabs and spalls from a larger machine which have been rejected by the screen.

The short head and concaves are fitted to either style D or style K Gates Breakers. The machine may be fitted with either the chilled iron head and chilled iron concaves, or manganese steel "gunlock" mantle and cast iron centre and manganese steel concaves.

A new double drum electrically driven hoisting engine built by the Lidgerwood Mfg. Company for the Inca Mining Company, which was shipped recently, will have to travel over an interesting and complicated route before it reaches its destination beyond the summit of the Andes in Peru and be set up for use.

The Santo Domingo Mines, for which the hoist is destined, lie in the old dominion of the Incas in Peru and behind the Lake Titacaca region where the Spanish conquerors found such stores of precious metals.

The Santo Domingo Mines were discovered about twelve years ago by a couple of Peruvians who had wandered across the summit from Arequipa in search of placer gold. Suddenly they discovered a vein of gold-bearing ore where a landslide had uncovered the native rock. A year later the property was acquired by a party of men of Bradford, Pa., and the Inca Mining Company and the Inca Rubber Company were formed. Besides the mining property the Bradford men have a concession of about one million acres of rubber producing lands which they are developing. Work on the mines was begun about eleven years ago, and more than two and a half million dollars worth of gold has been taken out up to this time. The company has about thirty miles of tunnels, shafts and drifts opened up.

The hoist which is now on its way is to be placed in a tunnel which has been run 1,700 feet into the mountain, cutting the vein 1,500 feet below the outcropping, at the top of the hill. A 500-foot-deep shaft has been sunk from the tunnel, and the new hoist is to bring the ore from the lower workings to the tunnel level. Accompanying the hoist are two 200 kilowatt General Electric generators. These will furnish current generated from a water power to operate the hoist, mill and other machinery of the mine. The mill contains 10 stamps, a concentrating and a cyaniding plant. The hoist will go by steamer to the port of Mollendo. From there a railroad will take it to Tirapata in the Lake Titicaca region. There the Inca Mining Company will receive it and carry it 150 miles over roads of its own building, to the mine. The first part of the way for 100 miles is over a waggon road. This reaches to the summit of the Andes at Lake Arracoma, 16,000 feet above the sea level. The next 50 miles is only a mule road. To make it possible to transport the big hoist over this part of the route it was built in sections, with no one piece weighing more than 300 pounds. The total weight of the hoist is 13,800 pounds. The drums are each 48 inches in diameter with 40 inch faces. The hoist is designed for a duty of 3,000 pounds, to be lifted at a rate of 400 feet per minute. It is driven by a 37 horse power induction motor of the General Electric Company's make, and operated by a 440 volt alternating current.

The power house is about a mile away from the mill. It is intended to develop about 250 horse power at first, and this can be doubled by adding another standpipe. The mine lies at an elevation of 5,000 feet above the sea. Beyond the mine the company has built a road about 75 miles long to the Tambopata river, where it is now putting together a little steel-hulled steam boat for navigating the Tambopata, Madre de Dias and Beni rivers. At the crossing of the Irambari river the road is carried by a wire rope suspension bridge, 320 feet long. Telephone lines 250 miles long, belonging to the company, connect the mines with the railroad and points where work is being prosecuted.

Safety Blasting Fuse was invented in 1836 by the late Wm. Bickford, of Cornwall, England, and the firm of Bickford, Smith & Co., Ltd., are his successors. White Jacket Fuse is their latest production, and takes the place of Blue Jacket Fuse, which was introduced into South Africa and Australia four years ago, and into Canada quite recently by Mussens Limited. The blasting fuse, which is ordinarily used all through the Dominion of Canada at the present time, is white countered gutta percha. One of the properties of gutta percha is that, on keeping for several months, it perishes, and owing to this property, it has always been necessary to be sure that gutta percha fuse was fresh from the factory, or at any rate not more than six months old, in order that it might be perfectly safe in wet ground. If the gutta percha has perished in any way, the fuse is very likely to crack and let damp into the powder, which would prevent the fuse burning through to the end, which would cause one of those misfires, which frequently lead to serious loss of life. In the White Jacket Fuse the water-proofing is put on twice with a special black varnish, the composition of which is the property of Bickford, Smith & Co., and which no one else has yet been able to successfully copy.

White Jacket Fuse will stand twenty-four hours immersion in water, and this is far more than is ever required in practice. Instead of having to be used as soon as possible after leaving the factory, it can be kept for one or two years without in any way deteriorating, and is of great importance in the case of a commodity like fuse, which is held in stock by dealers in different parts of the country, making it almost impossible for the customer to tell how long the stock has been held. Besides these special qualities, the burning speed of the fuse is every regular, and is guaranteed to vary less than ten per cent. on either side of the standard. It also stands rough handling and rapid changes of climate and temperature better than any fuse which has ever been on the market in Canada before.

The Hancock Cons. Copper Co., Mr. John L. Harris, Supt., whose mines are located at Hancock, Mich., has recently ordered from the Sullivan Machinery Co., of Chicago, a hoisting engine to be used for sinking the principal shaft and for permanent service, after the shaft is completed to its final depth of 4,000 feet.

This hoist will be of the first motion, heavy duty, Corliss type, with engines 24 in. diameter by 48 in. stroke; and two loose drums, 8 feet in diameter by 9 feet long, driven by band friction clutches, and designed for hoisting in balance. The drums will be grooved for 1 1-4 in. steel rope, and the maximum hoisting speed under full load will be 3,500 feet per minute. The clutches and band brakes will be steam operated, with automatic compressed air substitution, in case the steam pressure falls below a given point, owing to accident or for other reasons.

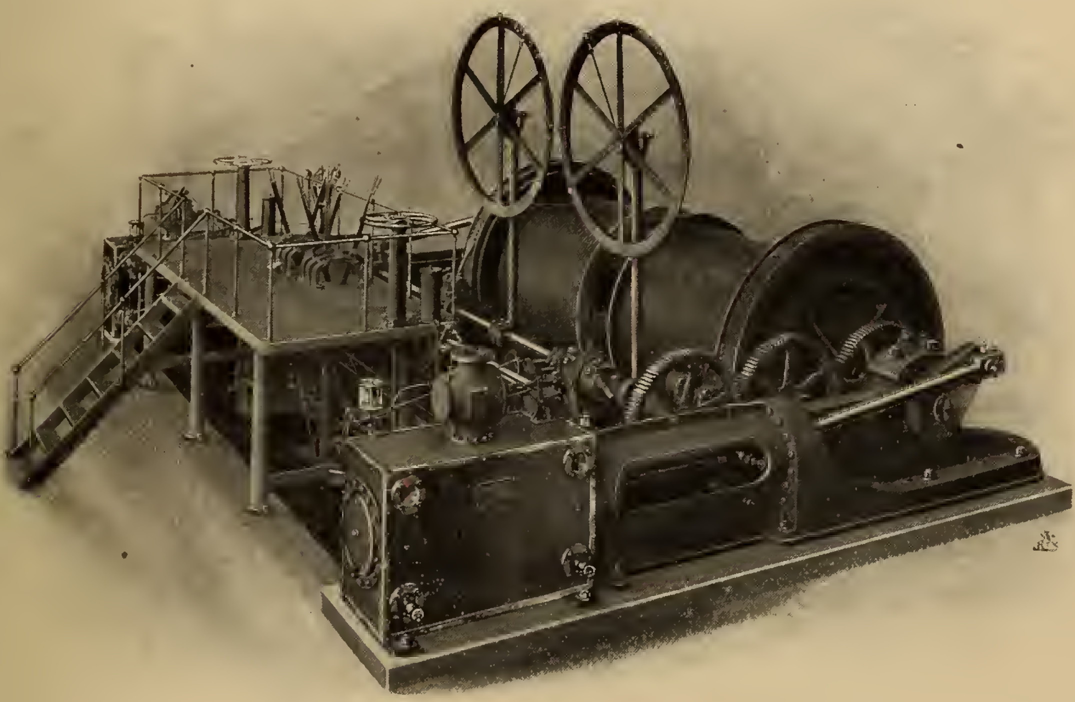
This hoist will be furnished with the Sullivan patented automatic throttle closing device and interlocking automatic stop. By these contrivances, the steam will be automatically shut off at a fixed distance from the top of the shaft, allowing the engineer to bring the cage to a stop at the desired point, by use of the brake. In case the engineer, for any reason, fails to set the brakes, they will be set automatically at the proper point, to prevent an overwind.

Hoists of this same design have recently been furnished to the Republic Iron & Steel Co., Republic, Mich., the Ironton and Colby Mines, Bessemer, and the Dunn Mine, Crystal Falls, Mich.

The Silverford Cobalt Mining Company, Limited. Capital, $200,000, divided into two hundred thousand shares of one dollar each. Head office: Toronto, Ont. Provisional directors: T. H. Barton, F. D. Byers, and O. F. Taylor, all of Toronto, Ont.

The Jack Pot Cobalt Silver Mining Company, Limited. Capital, $750,000, divided into seven hundred and fifty thousand shares of one dollar each. Head office, Toronto, Ont. Provisional directors: R. S. Gilpin, D. A. Rose and F. T. Whittemore, all of Toronto.

Quebec Cobalt Mining Company, Limited. Capital, $1,000,000, divided into one million shares of one dollar each. Head office, Toronto, Ont. Provisional directors: J. E. Day, J. M. Ferguson, E. V. O'Sullivan, J. H. Hallett and Mary Donevan, all of Toronto.



Sullivan Hoisting Engine, Ironton Mine.

MINING INCORPORATIONS.

ONTARIO.

Mines, Limited. Capital, $40,000, divided into four hundred shares of one hundred dollars each. Head office, Toronto, Ont. Provisional directors: W. H. Moore, Gerard Ruel and Geo. F. MacDonnell, all of Toronto, Ont.

Cobalt Gem Mining Company, Limited. Capital, $1,000,000, divided into one million shares of one dollar each. Head office, Toronto, Ont. Provisional directors: J. E. Day, J. M. Ferguson, E. V. O'Sullivan and Mary Donevan, all of Toronto.

Silver Horse Shoe Cobalt Mining Company, Limited. Capital, $40,000, divided into forty thousand shares of one dollar each. Head office, Toronto, Ont. Provisional directors: Jos. Brown, Neil Sinclair and A. M. Harley, all of Toronto, Ont.

Kennedy Cobalt, Limited. Capital, $1,000,000, divided into one million shares of one dollar each. Head office: Toronto, Ont. Provisional directors: W. H. Jackson and J. A. Morden, of Toronto, Ont., and David Kennedy, of Toronto Junction, Ont.

Duluth Cobalt Mining Company, Limited. Head office: Haileybury, Ont. Capital, $500,000, divided into five hundred thousand shares of one dollar each. Provisional directors: J. F. Gillies and J. F. Hope, of Toronto, and John Mackay, of Sault Ste. Marie, Ont.

The Cobalt Mutual Mines Company, Limited. Capital, $100,000, divided into one hundred thousand shares of one dollar each. Head office, Haileybury, Ont. Provisional directors: Arthur G. Slaght, Hugh LeRoy Slaght and Wm. Henry Phelan, all of Haileybury, Ont.

Montreal Cobalt Power Company, Limited. Capital, $1,000,000, divided into ten thousand shares of one hundred dollars each. Head office: Toronto, Ont. Provisional directors: J. W. Bain, G. B. Strathy, R. R. Perry, L. C. Todd, and J. E. Riley, all of Toronto, Ont.

Cobalt Mines Syndicate, Limited. Capital, $100,000, divided into one hundred thousand shares of one dollar each. Head office, Toronto, Ont. Provisional directors, J. E. Day, John M. Ferguson, E. V. O'Sullivan, James H. Hallett and Mary Donevan, all of Toronto.

London-Cobalt Mining Corporation, Limited. Capital, $2,000,000, divided into two million shares of one dollar each. Head office: Toronto, Ont. Provisional directors: Geo. Stevenson, F. H. Potts, J. W. McDonald, E. Gillis, and Eva Lena Bradley, all of Toronto.

The Cobalt Ore Sampling Company, Limited. Head office: Cobalt, Ont. Capital, $100,000, divided into one hundred thousand shares of one dollar each. Provisional directors: W. H. Fletcher, G. W. Parker, C. H. Moore, G. A. Woodward and George Ross, all of Cobalt, Ont.

Independence Cobalt Silver Mines Company, Limited. Capital, $1,000,000, divided into one million shares of one dollar each. Head office, Toronto, Ont. Provisional directors: W. M. Williams, Joplin, Missouri; C. E. Mabon, of Lewiston, New York, and C. E. Loomis, of Attica, N.Y.

The Sharpe Lake Cobalt Silver Mining Company, Limited. Capital, $1,000,000, divided into one million shares of one dollar each. Head office, Ottawa, Ont. Provisional directors: J. E. Murphy, W. Abbott, of Cobalt, Ont., and W. R. Bradbury, W. E. Matthews and R. G. Code, of Ottawa, Ont.

The Bucke Silver and Cobalt Mining Company, Limited Capital, $300,000, divided into three hundred thousand shares of one dollar each. Head office: Ottawa, Ont. Provisional directors: F. A. Heney, Nepean, Ont.; H. Hopp, E. L. Horwood, T. A. Beament and John L. MacLaren, all of Ottawa, Canada.

The Cobalt and Larder Lake Gold Mining Company, Limited. Capital, $300,000, divided into three hundred thousand shares of one dollar each. Head office: New Liskeard, Ont. Provisional directors: Geo. C. Legge, Norman Bingham Strong, W. J. Egan, J. J. Kelly, and H. D. Graham, all of Haileybury, Ont.

The Youngstown-Cobalt Silver Mining Company, Limited. Capital $1,000,000, divided into one million shares of one dollar each. Head office: Cobalt, Ont. Provisional directors: Geo. Albert Baker, Youngstown, Ohio; Walter A. Sadler, and D. H. Granville, of Cobalt, Ont., and G. W. P. Hood, of Toronto Junction, Ont.

The Casey Mountain Cobalt Mining and Development Company, Limited. Capital, $250,000, divided into two hundred and fifty thousand shares of one dollar each. Head office, Haileybury, Ont. Provisional directors: R. B. Fergusson, R. G. Williamson, Geo. A. Pollard, David A. Reid, all of Regina, Saskatchewan, and David Williamson, of Haileybury, Ont.

BRITISH COLUMBIA.

The Bay Gold Mining Company, Limited. Capital, $200,000, divided into two hundred thousand shares of one dollar each. Office in Yale District, B.C.

The Old Dominion Copper Development Syndicate, Limited. Capital, $35,000, divided into thirty-five thousand shares of one dollar each. Office, Kamloops, Yale District, B.C.

CATALOGUES.

The Atlas Engine Works, of Indianapolis, have issued Bulletin No. 134, showing the various engines and boilers manufactured by the Atlas Engine Works. The headquarters of the company are at Indianapolis.

Catalogue A describes the Butters Patent Filter. This will thoroughly filter and wash slime at a minimum cost, and will handle slimes that cannot be treated by any other method. The sales agents are The Blaisdell Company of Los Angeles, Cal.

"Everlasting," is the title of Catalogue No. 16, issued by Wendell & MacDuffie, 26 Cortlandt street, New York. This firm makes asbestos shingles, slates and sheathing, made wholly of mineral fibre, asbestos, and the best Portland cement obtainable.

The Report of the Board of Trustees and of the State Mineralogist, California State Mining Bureau, have been issued to cover the fiscal year ending January 30th, 1906. The total value of the mineral production of California during that period was $43,069,227.

A useful article in a prospecting outfit is a No. 10 forge; height 31 inches, width, 18 x 18 inches, weight, 125 lbs. They claim that if one of these forges should fall 20 feet its appearance might be spoiled, but it would be ready for business. Mussens Limited keep them in stock.

Mussens Limited send us a pamphlet descriptive of the Reading Multiple Gear Chain Hoist, capable of handling weights of from 1,000 to 40,000 lbs. Also some descriptions of hoisting machines manufactured by Marsh & Henthorn, of Belleveille, Ont., for which Mussens Limited are the agents.

The Sullivan Diamond Core Drills are known the world over, though some interesting details may be gained, even by experienced men, from Catalogue No. 5, issued by the Sullivan Machinery Company, Railway Exchange Bldg., Chicago. It leaves very little to be said about the Sullivan Diamond Drill.

The Hathorn Works of the Western Electric Company are adequately described in a well illustrated pamphlet issued by that company. A map showing the positions of the different branches of the Western Electric Company, may be found useful by those wishing to procure electrical apparatus and supplies.

Catalogue No. 1, issued by the C. L. Hathaway Rock Crusher Company, Denver, Col., is descriptive of the Gyratory Rock and Ore Crusher manufactured by that firm. Every part of the crusher is shown, and a very full description of its mechanism, and the mechanical principles involved is included.

"The Diamond Drill and its Work" is the title of Catalogue No. 26, issued by the American Diamond Rock Drill Company, 95 Liberty street, New York City. Anyone having drilling to do would do well to procure a copy of this pamphlet before deciding where to order. Several of these drills are in use in the regions about Cobalt and Sudbury.

"Westinghouse Motor Applications" this month treats of A.B.C. Disk Fans. The introduction to this pamphlet states that ventilation is a subject that can never receive too careful consideration—a statement with which our readers well agree most thoroughly. Westinghouse motors from .25 to 2.85 h.p. are suitable for driving fans 18 inches to 60 inches in diameter. The Canadian Westinghouse Company will be pleased to send this pamphlet to all enenquirers.

Westinghouse Motor Applications, is the name of a little booklet issued by the Westinghouse Electric Manufacturing Company of Chicago, represented in Canada by the Canadian Westinghouse Company, Limited, whose general offices and works are at Hamilton, Ont., with branches in Toronto, Vancouver, Winnipeg, Montreal and Halifax. This publication deals with the use of the small power motor for blacksmiths and blowers. Small motor powers are to-day replacing hand drive with even greater success than has been attendant upon the replacement of other forms of power drive by the larger types of motors.